GAS JOURNAL

LIGHT ∴ HEAT ∴ POWER

BYE-PRODUCTS.

[Founded in 1849 as the "Journal of Gas Lighting."]

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JANUARY TO MARCH, 1928.

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WALTER KING, LTD.,

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Editorial Notes.

The New Year—Anticipated Events.

THE list of anticipated events which will intimately concern the gas industry in the current year is not entirely of its own making—indeed, far from it. If it could order matters wholly its own way, several of the items would not appear. The elements of the compilation are contributed from within and from outside the industry. They constitute advantages and disadvantages to its interests; and, combined, they will claim from those responsible for its welfare very definite consideration as to policy and method. There was at one time a disposition on the part of professional gas men to regard its affairs—production and trading—as having firmly established a highway which would merely go on broadening and extending without the relinquishment of anything, and without the incorporation of new forms of business or new products for the realization of maximum success. Those old notions were long ago rudely upset. We know now that the gas industry does not market a single product that is not subject to keen competition in one shape or another, and the signs are that the competition will grow. In no direction can progress be stayed. If progress threatens to affect detrimentally the interests of an industry, then that industry, if it is wise, will set to work to make such progress in that direction as to avert the effects, or to devise ways and means to substitute a new type of business for the old, so that, on balance, the effects are nullified. The gas industry has in the past been highly successful in accommodating itself to changes in respect of competition with its primary product. But new changes have come, or are developing; and we are moving with certainty into a position in which our trading environment will be greatly different from what it was in the past. There is satisfaction with what is being done towards meeting new circumstances; but it is easy to see that a great deal more will have to be accomplished as time advances if the industry is to make the best of its advantageous position. Old methods will probably have to be completely abandoned, and new ones will have to take their place. In many quarters, those who are responsible for the interests of the gas industry are fully conversant with all this. Is it recognized universally in the industry? Observation gives a reply in the negative.

Industries adopt new manufacturing processes and trading methods without any reference as to how they will affect other enterprises. That is not their business. Every industry has to keep advancing in bringing into material and utilitarian effect its own potentialities. The gas industry has had large illustration of this. It has had it in the development of the electricity industry; in the rise of the synthetic nitrogen industry; in the commercial activity of the bitumen interests; in the growth of bye-product coking, and in the nascent development of that industry in the domestic coke market; and we are not altogether sure what will happen in connection with low-temperature carbonization, and in respect of (say) the hydrogenation of coal. We see international relationships springing-up in the chemical industries. All this progress, already accomplished or prospective, bears upon our fortunes in some way or other. We have to face the conditions, and not let them come upon us without making an effort to meet them, or to minimize their effects, even though it means discarding old systems and adopting new.

Within the bounds of present knowledge, one thing is certain; and it is that coal carbonization must continue. Gas is an essential of day-by-day service; elements of coal which are necessaries to the very existence of other industries cannot be released without high-temperature treatment. We are very confident as to the future of gas; but the growth of application depends on low price (to which secondary products so largely contribute), utilization efficiency, and business expansion. As we enter upon the work of the New Year, we are confronted by the development of coal-selling organizations; and no secret is made of the fact that it is the intention, by imposing agreed minimum prices, to make public utility undertakings and other enterprises pay higher prices per ton, which are pleasantly described as "economic values"—at present a term that has not been defined on a cash basis. Some of the colliery owners who are hoping to enforce the payment of higher prices by the gas and other industries of the country are the proprietors of coke-oven plants, who desire the industry to buy gas in bulk from them, and who are making preparations for a larger business in the domestic coke market. Naturally, we do not expect the colliery people to run their businesses at a loss, if production and all else appertaining to them are economically conducted; and we do not blame them for doing the best possible for themselves in respect of their secondary products. We have to do the same. We have to see that our products are of high quality and in acceptable condition; and so long as supply is only equal to, and not largely in excess of, demand, it will make little difference to the gas industry. Coke competition has to be met.

There we have two respects in which change is predicted—coal dealings and coke competition. Then there is electrical development. The Government scheme will not immediately produce its effects, whatever their nature. They will be gradually evolved. But we have against us a large growth of the so-termed "assisted wiring" and the application of the two-part tariff. There will be growth in these directions this year. Gas protection will be by "service," and all that it brings in its train. Additional plants are being constructed for synthetic nitrogen production; we know what that means, unless the demand for sulphate of ammonia greatly expands. The bitumen people will not take lying down the activities of the coal tar industries; it may therefore be expected that this year their activities will increase It is anticipated, too, that, before the end of this year, the hydrogenation process will be placing on the market a considerable supply of oils from coal. If commercially successful, and there are large de-

velopments (as in the case of synthetic nitrogen), will tar values be affected? That is a question time alone can answer. We may yet come to total gasification for at any rate part of our coal.

What is the gas industry doing? It is working energetically to consolidate its position, and to extend its powers, through the legislation the National Gas Council has in hand, and which we are hoping will be before Parliament ere long. The additional powers are urgently required. There could, however, be—without waiting for the new general legislation—more activity in respect of area extension and the absorption of uneconomically provided gas supplies. Though gas companies cannot adopt a two-part tariff without legislation, we should like to see the wider application of a commercial policy which in itself would certify appreciation of new needs and of the prospective intensification of competition. Before this year is out—mark this!—there will be cause for greater recognition of the prudence of those gas undertakings which have set seriously to work to fortify their position. With the broadening of local service and trading policy, there must be no lapse in, but rather an extension of, centralized propaganda. Nothing must be allowed to assail the industry's power in that direction. The sames applies to our research work. If, further, the industry does not wish to stem the development of its own favourable potentiality, it will do its utmost to promote the higher standards of training for those who are destined to be the responsible officers of the industry. In association with these last-mentioned aspects of our work, we are glad to find that at length we are to have a real fusion of the technical talent of the industry, which has hitherto been subjected to segregation by some absurd and inscrutable distinction between gas-supply and gas-plant technicians. This we hope will all be definitely altered this year; and, if it is, it will be a good contribution to essential consolidation.

It will be seen from this article that this year we anticipate several developments, definitely either in favour of, or against the interests of, the industry. They point to the need of partial recognition being replaced by universal appreciation; of more powerful activity in those quarters where laxity prevails; and of the proceeds of collective wisdom being translated into individual practice.

The Piccadilly Bitumen Gas Explosion.

By this time the daily newspapers should have learned that explosions in streets or houses are not always due to the commodity supplied by gas undertakings; and they should therefore take precautions to satisfy themselves as to the source of the gas before making representations (which may be false) about it to the public. They must have heard of numerous explosions in which electricity, aided and abetted by the bitumen integument of cables, has, through a fusion of the cable, generated a highly explosive and poisonous gas, which, on being fired, has exploded and caused much damage and public consternation. Yet the newspapers will persist in their traditional error of attributing every fresh explosion to gas escaping from the gas-supply mains. We have another example of this in the Albemarle Street, Piccadilly, explosion on Dec. 29, to which the newspapers gave prominence the following day. The "Times" report may be taken as an example of hopeless inaccuracy. The event undoubtedly caused considerable local alarm, and the services of a large force of police were requisitioned to maintain order and prevent further accident, owing to the explosions, the flames from the pavement, and the jeopardy of the Royal Institution, the basement of whose premises was damaged. "The Times" distinctly indicated, though it did not positively state, that the gas supply was responsible. It remarked that there was "danger of the fire spreading along the mains of the Gas Light and Coke Company," and afterwards the remark was made: "The cause of the fire is at present unknown; "but it is thought the severe weather may have resulted "in the bursting of one of the gas mains." As a matter of fact, coal gas did not participate in the explosion in any way, as the Secretary of the Gas Light and Coke Company (Mr. W. L. Galbraith) stated in a letter to "The Times" on the following day. He was able to declare definitely: "No main of ours burst or was on fire, or "had to be cut-off. The cause of these 'gas explosions' "appears to have been an accumulation and then firing of "bitumen gas . . . generated from the material surround-"ing an electric cable in which fusion had taken place. "No gas-mains run through pavement boxes containing "electric cables or wires." The whole thing was analogous to the Acton explosion, which was the subject of an official inquiry last year, as reported in the "JOURNAL." Perhaps in time the daily newspapers will see fit to exercise a little more care before fixing blame upon coal gas for, or insinuating that it was the cause of, misconduct of the nature of this Piccadilly explosion and fire.

A Mighty Explosion.

THROUGH the kindness of the Equitable Gas Company of Pittsburg, Pa., we are able this week to publish a short authentic account of the appalling explosion which, early on the morning of Nov. 14 last, shook the city, caused death, heavy personal injury, and damage to property, and produced unparalleled consternation among the populace. Accompanying it is a remarkable photograph showing the plight of the property in the zone of destruction. Though the article vividly relates what happened at the time of the catastrophe, it is clear that the best of descriptive matter must fail to shape the ideas of those at a distance as to what actually occurred. To those who were present, the great shock of noise, mountainous flame, reddened sky, and falling structures must, during the minutes succeeding, have startled their imaginations almost into the belief that the end of all things had come. Though we read the words, it is impossible to picture in our minds the sudden burst of gigantic flame that threw "a ghostly red light over the whole city." We try to imagine, but it is ineffectual, "a roar of greater volume than a thousand Niagaras, a shock like a mighty earthquake, and a fiery cloud of smoke that reached the clouds in the heavens." It is altogether beyond our power of conception. But if it is not beyond that of others, then they will be able to realize what was experienced by those who were there. For our part, we confess to the inability to do more than place a meaning upon the words describing the awesome noise and light, and to call to our aid the picture portraying the effects upon property.

The cause of, or the contributory circumstances to, the great calamity have not yet been positively determined. But all the evidence points to the greatest care having been taken to prevent accident while the 5 million c.ft. holder was under repair. The work had been going on for about three months. During the afternoon of the day before the explosion, tests revealed no indication of the presence of gas. The following morning—the day of the disaster—the position was that the tank was partially filled with water; and the holder was raised by admitting compressed air. In some unknown manner, gas must have leaked into the holder, and an acetylene torch or some other device used in the repair work ignited the explosive mixture. It seems to us on the facts presented that the question of how the explosive mixture became ignited is pretty well established; the primary problem is how did the gas get into the holder. No doubt there was interconnection with the neighbouring holders. If this is so, and there was no indication of gas leakage from one holder to the other prior to the day of the catastrophe—the repair work having been going on for three months—then something must have happened immediately preceding the catastrophe to allow the transmission of gas to take place. However, a compefent body of experts are, as the communication from the Equitable Gas Company tells us, probing thoroughly into all the phases of the problem with the view of, if possible, determining it. The bursting of the 5 million c.ft. holder caused flying steelwork to puncture two adjoining holders—one of 6 million c.ft. and the other of 800,000 c.ft. capacity. The gas was immediately ignited, and the flames shot into the air. There is nothing mysterious about that. The saddest features are the loss of lives and the human suffering that was caused. The estimates of the damage to property vary between $3 million and

$5 million. As the photograph shows, the devastation wrought was widespread.

Impressive is the great community of help which the explosion at once evoked. Organizations and individuals immediately combined for rescue and other humane service. As promptly as could be, too, the President of the Company (Mr. A. W. Robertson) announced their resolve—a resolve which ignored legal responsibility and put in first place moral obligation—to settle directly all claims for personal injury caused by the explosion, and to repair all property damage suffered by house owners and tenants, and only to leave liability for damage to factories, warehouses, and business premises to later legal determination. Sincere sympathy with our friends in Pittsburg and with the sufferers from the explosion has been previously expressed. We combine with it the wish that they may soon be free from the anxieties into which the disaster and havoc plunged them, though the memories and financial consequences of it all will long remain.

The Coal-Selling Schemes.

OWING perhaps to the intervention of the Christmas Holidays, the position in respect of the formulation of coal-selling organizations has not changed much; but the time has not been wasted by the promoters and the colliery owners. Judging by reports received from the coal areas, it seems to have been the one topic of private consideration and conversation among them. The movement is a significant one for the buyers of coal, as it will fundamentally change the conditions of coal purchasing in the areas concerned. Therefore, as the subject will be prominent the next few weeks, let us, in alluding to the present situation, briefly restate the lines of the schemes which are before the country.

There is what is called the "Three Counties Scheme"—for Yorkshire, Nottinghamshire, and Derbyshire. In this case the objects are: (1) To study foreign markets with particular reference to qualities and classification, and to encourage exports. That is a commendable object. (2) To regulate supply in accordance with demand, in order to prevent violent fluctuations of price and irregular working. Upon this, buyers will not look so favourably, although admittedly a natural condition in manufacturing enterprises. (3) To consider any proposal for the improved marketing of coal. (4) On all coal raised to impose a maximum levy of 3d. per ton. This will form a fund to be used to carry on the organization, and to subsidize, in certain instances, the export of coal. Upon this home consumers will look with some disfavour, as it is obvious that, if the fund is to be employed for the lowering of export prices, coal used at home may have to pay more than the average of 3d. per ton raised for the benefit of buyers abroad. On the other hand, there may be a set-off by the export business so gained contributing to the lowering of average production costs. But, on balance, the home consumer is not likely to be an actual gainer; the contrary is more probable. (5) Regarding the regulation of output according to demand, each colliery is to have its quota fixed by a Committee; and a penalty of 3s. per ton is to be imposed on members whose overproduction exceeds 1 p.ct.

As to the prospects of the scheme being adopted, it is stated that in West Yorkshire over 90 p.ct. of the output is represented by the owners who are in favour of it. South Yorkshire, it is reported, is also strongly supporting the scheme; but, at the time of writing, no definite decision has been announced. Concerning Derbyshire and Nottinghamshire, there seems to be some hesitancy, and there is not unanimity. All that is said is that the major feeling is in favour of the scheme; but there are present doubts as to whether representation of 90 p.ct. of the output will be realized. Upon the scheme, the Lancashire and Cheshire owners are, individually and collectively, keeping close watch, and making examination of it in the light of their own conditions; but, of course, they are not so interested as Yorkshire in the export trade.

The South Wales Coal Marketing Association is, practically speaking, an accomplished fact. The Committee appointed to consider and recommend the details of the scheme have completed their work; and the result was distributed among the colliery companies last Wednesday. To-morrow the owners meet to consider the report. The broad principles of the scheme have already been adopted. They comprise: (1) Effective control by the Association of all matters appertaining to the scheme. (2) A contribution of 3d. per ton on the total output raised at each colliery over each period of four weeks. This will form a pool, from which (3) compensation will be paid not exceeding 2s. per ton on output lost at the minimum price. (4) Grouping of collieries, classification of coals, and fixing of minimum prices. (5) Penalty of 2s. per ton for selling below the minimum price. It will be observed that in this scheme there is no provision as to the restriction of output, as in the case of the Three Counties scheme. But the promoters of the Yorkshire scheme say that previous experience convinces them there can be no effective price regulation without output control. On the other hand, the South Wales owners contend that minimum prices and penalty for disobedience to them are sufficient. It is also submitted that clause 23 of the South Wales scheme carries this important assurance to buyers: "Minimum prices must be fixed sufficiently low to en-"courage an increased volume of trade, and in no cir-"cumstances must the proceeds from such prices be "designed to exceed the average cost." It is hoped that the scheme will ultimately benefit the consumers, for at present the collieries are working short time, which adds considerably to the cost of production. Large consumers will no doubt most devoutly share in the hope; but at present they cannot be blamed for looking somewhat askance at the proposals.

All-Electric Victims on Housing Estates.

WE are inclined to think that there ought to be established a Society for the Prevention of Cruelty to Tenants of All-Electric Dwellings on Housing Estates. On some estates they are compelled by the callous powers that be to sleep in rooms which are flueless, and often occupied by more than one person. It can well be imagined that during the severe weather through which we have been passing, all means of ventilation in such rooms will have been closed, in order to prevent draughts and, as far as possible, preserve what warmth there is in them. More unhealthy conditions there could not be; and yet our local authorities are supposed to give scrupulous consideration to the promotion and maintenance of health. They betray by action their willingness to turn a blind eye upon such a supremely important matter, in order to keep the other one wide open for securing business for the municipal electricity supply undertaking. To condemn people to live in an all-electric house in such weather as we experienced at Christmas time, and since, really ought to be an indictable offence, just as it is criminal to send unseaworthy ships to sea. Before the recent severe weather set in, a cry went up from people residing in all-electric houses on one of the Liverpool housing estates (see "Electricity Supply Memoranda" for Dec. 14, p. 737) regarding the physical torture they and their families were suffering owing to cold and dampness through the absence of any proper heating arrangements, while the city councillors who had inflicted this condition upon them were no doubt enjoying perfect heating comfort in their own homes. If those poor residents complained so bitterly early in December, what must have been their feelings regarding the state of things towards the end of the month—at the time when we are exhorted to peace and goodwill? There can be no peace with the body in frozen state, and there can be no goodwill towards those tyrannical rulers who enacted that these people and their children should have the minimum of warmth (though arctic conditions prevailed) by the most costly method of room heating. Such weather as we have been having demands heat in a house the whole day through; and fifteen hours with only (let us assume) one 3-KW. fire means, at 1d. per unit, 3s. 9d. a day or 26s. 3d. a week—for a fire in only one room! It is a positive scandal where people cannot help themselves. Where they can do so, well then they deserve, for being so foolish, all the discomfort and expense to which they are subject. We have no sympathy for them; but we have for those hapless tenants of all-electric houses who

are the victims of a grasping policy in respect of new business for municipal electricity concerns. However, the gas industry have nothing of which to complain in regard to favourable conditions for business this winter; what with fog, rain, snow, and severe frosts, the consumption of gas has been of a heavy order. But it has been met without difficulty. The demand for heating purposes alone which gas undertakings have been called upon to satisfy during recent weeks would have been beyond the compass of the electricity supply industry; and economic considerations would not allow them to make provision for such erratic business.

The New Session.

Parliament will reassemble on Feb. 7.

Market Reports.

Through Christmas postal delays, our tar market report did not reach us in time to be included in our last issue. The two weeks' reports are therefore published this week. The coal market reports also cover the fortnight's position.

Imports of Coal.

The imports of coal during the eleven months ending with November last amounted to 2,416,694 tons; the value being £6,607,410. In the corresponding period of the coal stoppage year, 17,794,701 tons were imported, of the value of £37,177,033. The price paid last year for imported coal when contrasted with that of the coal we exported indicates that the former represents the winding-up of contracts entered into, for protection purposes, during the troubles of 1926.

Tar and Trout.

There is interest in an article which appeared in "The Times" on Dec. 19 last, from a "Scientific Correspondent." It deals with experiments on the toxic effects of tar on trout which have been made at the Research Station of the Ministry of Agriculture and Fisheries at Alresford. From what is said, it would seem that there has been much exaggeration regarding those effects. In fact, it is asserted that the discharges from a modern road used chiefly for motor traffic are less harmful to adjacent streams than was the organic refuse when horse traffic was supreme. While it is true that tar contains many poisonous substances soluble in water, which may find their way into water occupied by fish, it appears that the first effect on the fish is one of stimulation, which induces them to get out of the dangerous surroundings into more wholesome water as quickly as possible. The experiments show that the fish recover quickly in clean water. The general conclusion is that the stimulus to escape, and the power of recovery in clean water, are enough to make the danger to adult fish from road poisons very slight. Regarding the stationary ova of trout and other fish, and the alevins or very young fish, surprising but comforting information has been obtained. The experiments are briefly described; and the conclusion is that the presence of tar contamination in dilutions as strong as could be expected in open streams, and strong enough to affect adult trout, has no appreciable influence on the fertilization or development of the eggs up to the time of hatching. As to the alevins, experiments prove that they have very high resistance to tar contamination, but that the resistance decreases with their age. In the concluding observations, a point of scientific interest is that the poisons act through the brain, the eggs have no brain, and in the young fry the brain only slowly acquires its adult responsiveness.

The Statements Challenged.

Some of the statements referred to in the preceding paragraph have since been challenged in "The Times" by Mr. R. L. Marston, who states that the full report of the Joint Fisheries Transport Committee has not yet been published. The Committee were appointed to investigate the question of tar damaging fisheries; and the results of laboratory and field experiments, he declares, proved beyond question that washings from tarred roads, even when highly diluted, were extremely poisonous to fish life. A statement to this effect is printed as a preface to a recently issued report on "The Effect of Aqueous Extracts of Tar on Developing Trout Ova and on Alevins," by Mr. A. C. Gardiner, M.A., of the Alresford Fisheries Experimental Station, and is signed by Mr. E. S. Russell, Director of Fishery Investigations. Mr. Marston hopes that Mr. Gardiner's experiments on the effect of tar solutions on ova and fry will prove correct; but, as to adult fish, he emphatically says the statements of the "Scientific Correspondent" of our morning contemporary are most misleading. The criticism concludes with these remarks: "The slight pollution of rivers from tarred road washings is one of the most insidious forms of pollution. The fisheries deteriorate slowly; and it is almost impossible to furnish proof that the deterioration is due to tar." This being so, and instead of writing with obvious acerbity, Mr. Marston should devote himself to considering whether it is not possible that other polluting substances which are dropped on the hardened surfaces of tarred roads may have something to do with the injury to fish life.

Hire-Purchase Bill.

To "The Electrical Review," Mr. W. Eric Jackson recently contributed an article on "The New Hire-Purchase Bill." He tells us that it is a simple measure of very few words. Its effects may be summed-up by stating that goods which are out on hire-purchase, and which remain the property of the person selling them on hire-purchase terms, are not to be liable to distress for rent. While that is the effect, it is necessary to qualify it by saying that the terms of the hire-purchase agreement must be such that the ownership of the goods remains in the dealer until the completion of the payment of the instalments. Mr. Jackson points out that some years ago the Courts decided that the vital distinction between cases where the ownership remains in the dealer, and cases where it is transferred immediately to the buyer, is the presence in the hire-purchase agreement of a clause stating that the buyer is to be entitled at any time to return goods, and be under no further liability. When the buyer can return the goods in this way, it is obvious that the agreement is one of hiring and not one of purchase. The new Bill only covers those cases in which goods are not the hirer's property, but remain the property of the dealer through the presence in the agreement of a clause such as the one mentioned. Therefore, if the new Bill passes, the owner of hired goods will only be secure provided that the hire-purchase agreement is a hiring and purchasing agreement in the full legal sense, and is not an agreement for sale with payment by instalments. The agreement must also contain a clause permitting the hirer to return the goods at any time, to put an end to the agreement, and to be under no further liability. This will mean adjusting hire-purchase rates so as to ensure that depreciation is covered at a fairly early stage in the transaction.

Local Expenditure.

Of course it would be a big thing to have a Royal Commission investigating the whole system of local administrative finance, and much time and expense would be incurred. The Minister of Health, the Rt. Hon. Neville Chamberlain, apparently does not think that the issue would be worth all that would be involved. The fact remains that our industries and trade generally are groaning under inordinate taxes and rates; and yet it seems impossible to do anything to bring even a little relief. In a reply to a letter sent to him by the Director of the National Union of Manufacturers (Sir John Corcoran), Mr. Chamberlain subjects the available figures to detailed analysis, and from it he concludes that the data by no means support such a charge of general extravagance as might at first sight appear. It would be unfair to judge the work of local authorities generally from those whose prodigality has been the subject of public notice and censure. However, Mr. Chamberlain recognizes the imperative need for economy in local expenditure, and pledges himself to do everything in his power to that end, consistently with the needs of the community.

Unemployment Expenditure.

The total sums paid since the Armistice to Dec. 10 last by way of out-of-work donation and unemployment benefit are

approximately as follows: Out-of-work donation, £62,448,000; unemployment benefit, £316,870,000.

Trade Disputes.

The reputation of the year 1927 will stand well among recent ones in the matter of working days lost through industrial disputes. Some interesting information on this point was given by Sir A. Steel-Maitland, Minister of Labour, shortly before Parliament was prorogued. He states that the number of working days lost through industrial disputes in 1924 was nearly 8·5 millions; in 1925, close upon 8 millions; in 1926, approximately 162 millions; and in 1927 (January to October) rather more than 1 million.

PERSONAL.

Mr. JOHN DEMAIN, Gas Engineer and Manager to the Ripon Corporation, who has been appointed, out of 102 applicants, to succeed Mr. P. J. Calderwood as Engineer and Manager at Spalding, is well known and greatly esteemed among gas engineers of West Yorkshire. He is a Past-President of the Yorkshire Junior Gas Association.

Mr. R. S. HILTON, who will be remembered by readers for the good work which he did while Secretary and General Manager of the Birmingham Gas Department, and who for the last nine years has been Managing Director and Deputy-Chairman of the Metropolitan-Vickers Electrical Company, of Trafford Park, Manchester, has accepted the position of Sole Managing Director of the United Steel Companies, one of the largest industrial combines in this country, owning blast furnaces, steel furnaces, rolling mills, collieries, and coking plants.

Mr. GUY SAVORY, who has been elected a Director of the Croydon Gas Company, is Managing Director of Messrs. A. H. Allen & Co., Ltd., flour millers, and takes a keen interest in local affairs.

Alderman D. C. DEWHURST has resigned from the position of Chairman of the Accrington District Gas Board, after occupying it for 23 years. Only on two or three occasions during his long period of service was he absent from meetings of the Board.

The retirement, in consequence of continued ill-health, is announced of Mr. WILLIAM J. RUSSELL from the Directorate of the Croydon Gas Company, whose service he entered 64 years ago as an assistant to the then Secretary, Mr. William Purvis. On the retirement of Mr. Purvis in 1871, Mr. Russell was appointed Secretary, from which position he retired in 1902, when he became a Director. At one time he was an Auditor, and subsequently a Director, of the old Carshalton Gas Company, which was absorbed in 1894 by the Croydon Company.

OBITUARY.

WILLIAM BELTON.

The gas industry will learn with great regret of the death, which occurred suddenly at Sevenoaks on Dec. 17, of Mr. William Belton, who for a period of some forty years was the widely known and greatly respected Engineer, Manager, and Secretary of the Shrewsbury Gas Light Company.

Mr. Belton, who had reached the good old age of 82 years, was born a few miles from Shrewsbury, and received a sound practical training under several engineers. His earliest connection with gas engineering and management was as assistant to his father, who for 35 years held the position of Manager of the Wellington (Salop) Coal and Gas Light Company. In 1868 Mr. William Belton proceeded to America, where he remained, engaged in railway surveying and construction, until 1873, when he returned to this country, and was appointed Superintendent of the South Shields Gas-Works, under Mr. W. J. Warner. While he was there, new gas-works at Jarrow-upon-Tyne were constructed; and here Mr. Belton gained more knowledge—especially in connection with the requirements for gas manufacture on a large scale.

It was in 1879 that Mr. Belton left South Shields to take up the position with the Shrewsbury Gas Light Company which he was to fill so ably and for so long a period. Much constructional work was carried out by him there; while, in addition to this, he enjoyed a considerable consulting practice, and remodelled several small gas-works in the neighbourhood. As from the beginning of 1916 he relinquished the post of Manager of the Shrewsbury Gas Light Company, but retained those of Engineer and Secretary. Mr. C. M. D. Belton (nephew of Mr. William Belton, and a son of Mr. J. C. Belton, then Engineer and Manager of the Chester Gas-Works), who had been with the Company for six years as Assistant Engineer and Secretary, was at that time also appointed Manager. This arrangement subsisted until the middle of 1919, when our deceased friend retired, and was succeeded as Chief Officer of the Company by Mr. C. M. D. Belton.

In 1880 Mr. Belton was elected an associate member of the Institution of Civil Engineers; while until the time of his retirement he was a member of the Institution of Gas Engineers, and of the Midland Association of Gas Engineers and Managers.

The funeral took place at the Greatness Cemetery, Sevenoaks; and among many beautiful floral tributes were wreaths from the Directors of the Shrewsbury Gas Company, the staff, and local Masonic Lodges. Of his many Masonic friends, only one, W.Bro. S. Freeman Burrows, P.Pr.G.J.W., W. Lancs., was able to overcome the difficulty of transport in the severe weather, and to pay his last respects.

The death has occurred at Newton Abbot, at the age of 83, of Mr. A. E. TYLER, who was for a number of years Secretary to the Newton Abbot Gas Company.

The Garstang and District Gas Company have suffered a loss by the death of Mr. ROBERT BOLTON, of Wigan, Chairman of the Board of Directors. He had been associated with the undertaking for over 28 years.

At the moment of going to press with this number of the "JOURNAL," the sad news reaches us of the death of Mr. THOMAS HOLGATE, who was for many years Engineer at Halifax. Reference to his work for the industry will be made later.

The death has occurred at Harrogate of Mr. CHARLES RICHARD FENWICK, of Messrs. Martin & Fenwick, Civil Engineers, of Park Row, Leeds. Mr. Fenwick, who was 78, was a member of the Institution of Civil Engineers, and a Fellow of the Surveyors' Institute, and was Consulting Engineer to the Hartlepool Gas and Water Company.

The death is announced at Tewkesbury of Mr. H. ROLAND WRIGHT, formerly of Cradley, who was a member of the firm of Messrs. Harper & Moore, Ltd., firebrick manufacturers and colliery proprietors. He was also a Director of the Town of Dudley Gas Light Company and the Brierley Hill Gas Light Co., Ltd., of both of which his father was Chairman.

The death occurred on Dec. 28 of Alderman WILLIAM F. VINT, of Cedar's End, Sunderland, Chairman of the Sunderland Gas Company for the last ten years. He had been a Director of the Company for 38 years, and for the same period was a Director of the Sunderland and South Shields Water Company, of which he had been Chairman for the last thirteen years. He had been a member of Sunderland Town Council since 1887; and from March, 1917, to November, 1919, he was Mayor of the Borough.

APPRECIATION OF THE "GAS JOURNAL" CALENDAR AND DIRECTORY FOR 1928.

A shoal of letters acknowledging the receipt of the "GAS JOURNAL" Calendar and Directory for 1928 has been received by the proprietors of the "JOURNAL," who, judging from the appreciation expressed in these letters, feel they have taken the right course in making this volume an annual gift to their subscribers. Gas engineers and manufacturers of gas plant and appliances alike refer in terms of praise not only to the contents of the Directory, but also to its convenient size; and some of our electrical friends have also expressed their appreciation. The following quotations from gas engineers' letters are typical:

> I consider it is quite a happy thought on the part of yourself and Directors to send a free copy of this publication to each of your subscribers; and I am sure it will go far towards interesting many who have not hitherto had the prevision to obtain a copy of it in the past, and will indicate to them what they have missed through their neglect.
>
> Congratulate you and Dr. Davidson upon a very excellent and useful compilation—a veritable gas managers' handbook—well printed on excellent thin paper—and a "top-hole" book in every way.
>
> It is beautifully published and contains a mint of useful information.
>
> It is a most interesting little book, and will prove very valuable during the year.

The following is from a retired gas engineer:—

> It contains a treasury of information, and will be most valuable for reference; while in addition it is produced in such a neat and handy form, it can always be available when travelling or on holiday. It sounds trite to refer to its quality, as you will be fully aware of that from its cost to you.

We give the following excerpt from a letter by a firm of gas plant manufacturers:

> We consider the "get-up" of the Calendar and Directory most admirable, and we congratulate you and Dr. Davidson on so admirable a production.

For our part we greatly value such testimony as the foregoing, which is illustrative of the very many letters received acknowledging the service which the volume will be to the numerous recipients.

Extra copies of the "GAS JOURNAL" Calendar and Directory can be obtained at 7s. 6d. each, post-free.

POTENTIAL INVESTMENTS.

VII.—THE COMMERCIAL GAS COMPANY.

The Commercial Gas Company, one of the three Metropolitan Companies, has a statutory area of 7 square miles, comprising the Boroughs of Stepney and Poplar, parts of the Boroughs of Bethnal Green, Hackney, and Shoreditch, and the County Borough of West Ham. The population is about 500,000; and of the 117,464 consumers no less than 91,000 are supplied through prepayment meters, or 77 p.ct. of the total number. This is a higher percentage than in any other gas company, and is a source of strength to the Company's business. During the year 1926 the gas sold was 19,828,320 therms.

The Company was incorporated by Special Act of Parliament in the year 1847; and further powers were obtained between the years 1850 and 1927. The Ratcliff Company, which was absorbed in the year 1875, was incorporated by Special Act in the year 1817. By the Company's Act of 1927, the sliding-scale provisions which, with certain variations, had been in force since the year 1875 were abolished. The Company was granted a basic price of 11d. per therm; and the selling price of gas may be increased or reduced above or below such basic price. Price, as from Christmas, 1927, 9d. per therm. Declared calorific value, 500 B.Th.U. The Company's capital stock (formerly known as 4 p.ct. and 3½ p.ct. capital stocks) is now described as ordinary stock, ranking *pari passu* for a 5 p.ct. basic dividend.

The capital powers are as follows:

	£
Ordinary capital (including £1,076,875 added on conversion)	2,073,280
Premiums received	12,422
Remaining unissued	254,298
Total authorized capital	£2,340,000

Of the unissued capital £149,298 can be raised by the issue of ordinary stock or preference stock (redeemable or irredeemable), and £105,000 by the issue of preference stock (redeemable or irredeemable).

	£
Loan capital—	
Debenture stock (including £135,937 10s. added on conversion)	475,000
Discount capital	4,226
Remaining to be raised	228,452
Total borrowing powers	£699,226

The amount to be raised may be borrowed on mortgage or be issued as debenture stock.

Transfer arrangements—common form. Fee for registration of transfer, 2s. 6d. Probate, death in joint holdings, marriage, power of attorney, or distringas, 5s. All classes of stock can be transferred on same deed (without extra fee), and in amounts and multiples of £5. Husband's witness of wife's signature, and *vice versa*, accepted. Voting—one vote per £250 ordinary stock. Director's qualification, £2500 ordinary stock. Auditor's qualification (other than chartered or incorporated accountant), £750 ordinary stock.

Accounts and dividends. Accounts made up to Dec. 31, and submitted in February; dividends on ordinary stock being paid about Feb. 15 and (an interim dividend) Aug. 15. The Company may not (except under the provisions shown below) declare larger dividends on the ordinary stock than 5 p.ct. per annum on stock issued prior to the passing of the 1927 Act, or 6 p.ct. on stock issued thereafter.

DIVISION OF SURPLUS PROFITS.

At the end of each year or half-year, a sum shall be calculated representing the amount by which the total amount payable by consumers during such year or half-year has been less than the amount which would have been payable if the gas had been charged for at the basic price, and such sum so calculated shall be called "the consumers' share." The "surplus profits" shall mean a sum of which the consumers' share is three-quarters. If and so far as the balance standing to the credit of the net revenue account, after providing for dividend on the preference stock (if any) and dividends at the basic rates on the ordinary stock, in the opinion of the Directors permits, a sum not exceeding one-quarter of the surplus profits shall be applied in two equal parts for the benefit of the holders of ordinary stock and for the benefit of employee co-partners of the Company. Any sum so to be applied for the benefit of holders of ordinary stock may be applied in the increase of the dividends above the basic rates, and if and so far as not so applied shall be carried to the reserve fund, which shall be available, *inter alia*, for increasing the dividends on the ordinary stock beyond the basic rates or for making the dividends up to the basic rates. No sum shall, however, be divided in excess of the basic rates or carried to the reserve fund or paid to the co-partners in respect of any period in which the price charged to the ordinary consumers is equal to or more than 0·4d. per therm in excess of the basic price. The Company shall not later than in the session 1932 promote a Bill in Parliament proposing a revision of the basic price or giving an opportunity for such revision to be made.

PROGRESS OF THE COMPANY.

The following table illustrates the progress made by the Company since the year 1903. The period of the war and the few following years have been ignored, owing to the abnormal conditions then prevailing:

Year	Average Price of Gas per 1000 C.Ft.	Quantity Sold. Million C.Ft.	Capital Expended per 1000 C.Ft. Sold.	Gross Profit.	Total Charge for Capital. (See Note.)	Rates of Ordinary Dividends. P.Ct. per Annum.	Amount Carried Forward and Balance Reserve Fund.
	s. d.		s. d.	£	£	£ s. d.	£
1903	2 6	2,818	8 9	125,572	113,770	5 4 0 *a* 5 0 0 *b*	52,462
1908	2 6	3,123	9 2	118,821	123,161	5 4 0 *a* 5 0 0 *b*	56,858
1913	2 4	3,403	8 6	137,579	128,441	5 9 4 *a* 5 6 8 *b*	132,412
	Per Therm. d.	Therms.	Per Therm. s. d.				
1923	9·6	17,658,566	1 9	161,925	144,263	6 0 0 *a* 6 0 0 *b*	127,768
1924	8·8	18,789,741	1 8	102,777	142,195	5 17 4 *a* 5 16 8 *b*	90,831
1925	9·25	19,188,128	1 7	139,810	134,121	5 6 8 *a* 5 3 4 *b*	99,118
1926	9·6	19,828,320	1 7	132,042	132,577	5 6 8 *a* 5 3 4 *b*	101,299

NOTE.—Total charge for capital includes dividend and interest paid and amount (if any) carried to reserve fund.

Having regard to the congested nature of this Company's district, the increase in the gas sales is very remarkable—especially as it has to contend with exceptionally low prices of electricity supplied by municipal undertakings. The growth of business since the year 1903, calculated on a volumetric basis, is 48 p.ct. The dividends in the above table are (*a*) on the old 4 p.ct. standard and (*b*) on the 3½ p.ct. standard stocks, both of which, as stated above, are merged and described as ordinary stock.

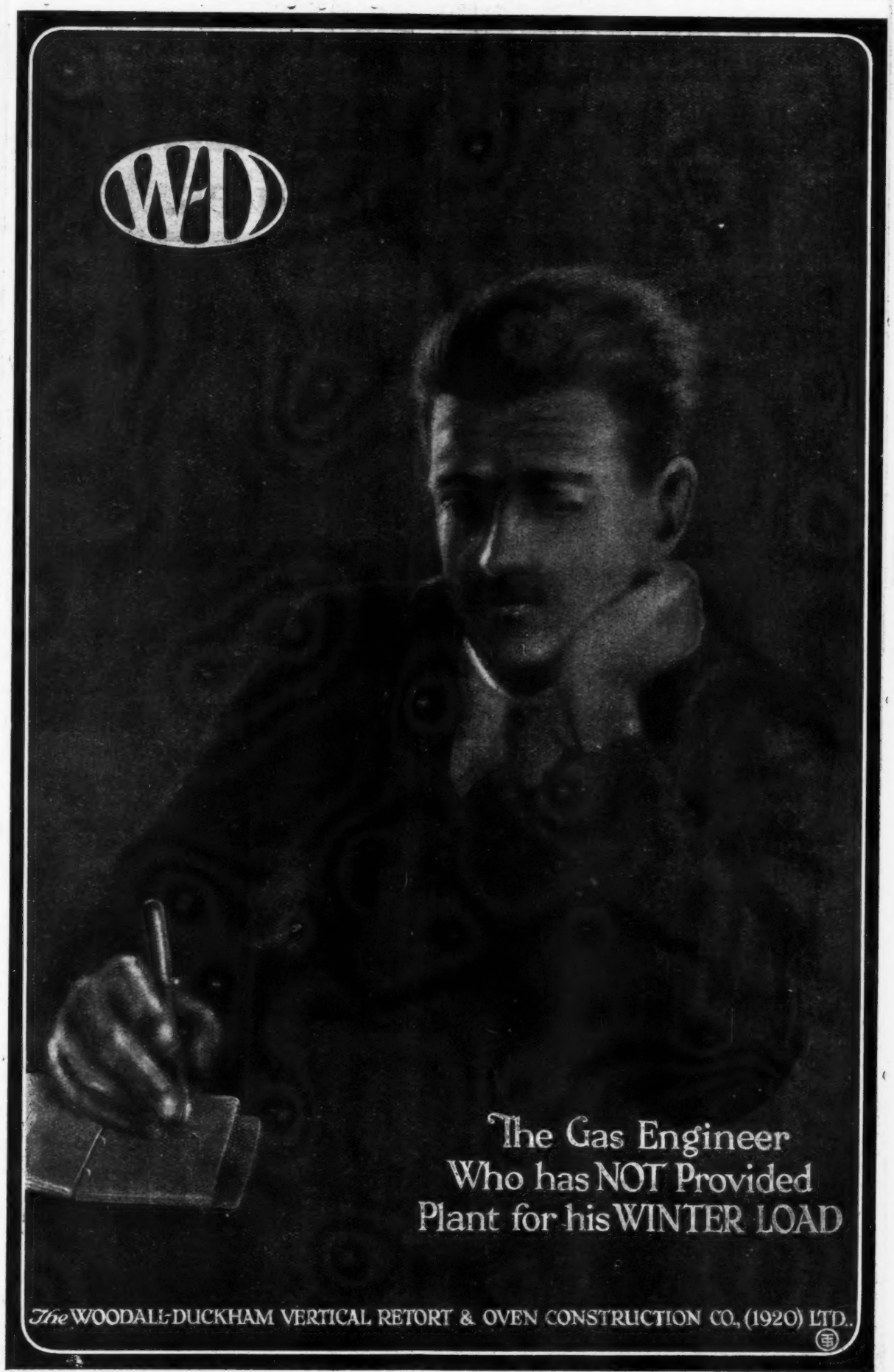
The ordinary stock is quoted in London, Birmingham, and Sheffield. The following table shows the prices of the highest and lowest transactions on the London Exchange each year since 1923, the dividends paid, and the yield on the average price:

Year.	Transactions of 4 P.Ct. and 3½ P.Ct. Stocks.		Average Dividend on the Two Stocks P.Ct. per Annum.	Yield P.Ct. per Annum.
	Highest.	Lowest.		
			£ s. d.	£ s. d.
1923	99⅜	92½	6 0 0	6 4 10
1924	96	89	5 17 0	6 6 6
1925	96½	78	5 5 0	6 0 4
1926	84	74	5 5 0	6 12 11
	Now known as ordinary stock.			

The value of the ordinary stock has risen appreciably during the year, and the average price at the present time is 94, which, on the last average dividend distribution (£5 5s.), equals only £5 11s. 8d. p.ct. The rise in the price seems to indicate a prospect of a higher dividend. While it is not possible, under the basic price system, to determine the dividend payable for the year until the accounts are completed, the gross selling price for the current year would appear to permit the payment, if profits permit, of a substantial addition to the basic dividend of 5 p.ct. in February next.

Low-Temperature Carbonization Retorts.—"A Well-Known Engineer," writing in the "Chemical News," says it is interesting to note that strong claims for low-temperature carbonization retort construction are now being made on behalf of genuine cold blast pig iron. This is a speciality of Messrs. Robert Heath & Low Moor, Ltd.; and it is maintained that the well-known dense and tough character of cold blast iron, much superior to the ordinary hot blast iron, will overcome the difficulties of wear and tear.

Institution of Chemical Engineers.—The sixth annual corporate meeting will take place in London on Friday, March 9, of the Institution of Chemical Engineers, whose President is Sir Alexander Gibb, G.B.E., C.B.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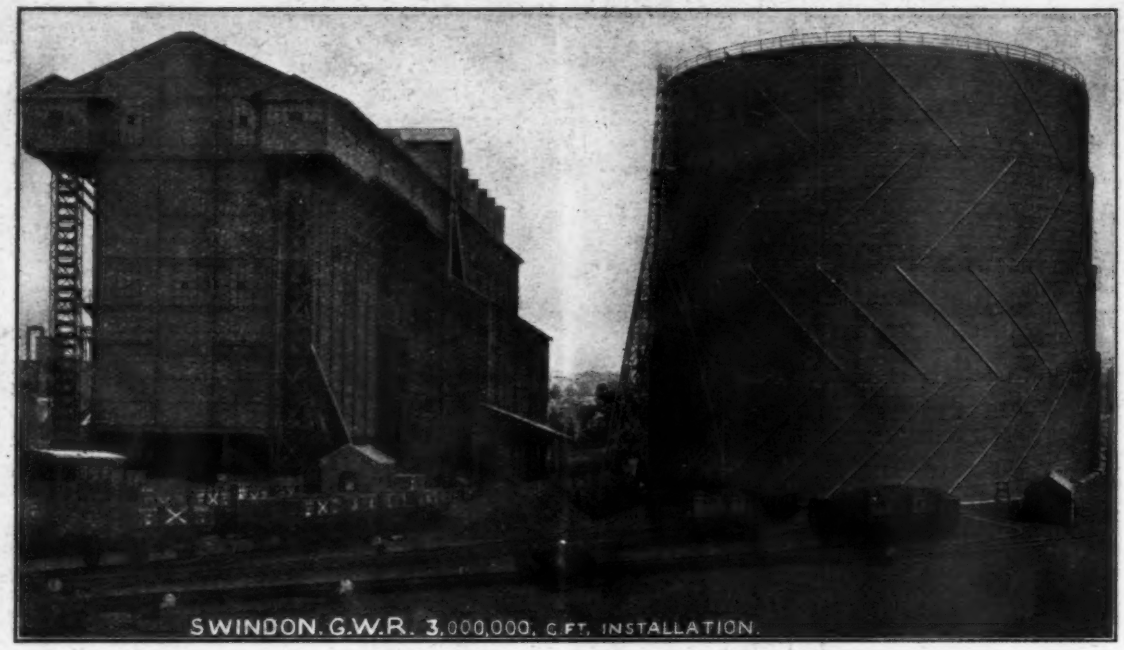

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ELECTRICITY SUPPLY MEMORANDA.

THERE is lamentation in the land of electricity. The report of the Electricity Commissioners (from which some interesting particulars were given last week) does not come up to expectations in respect of the year 1926, compared with the previous one. It has been said, very emphatically and often, that the coal strike made enormous demands upon the electricity undertakings, and that never were heating connections made with such vigour and in such number. What really happened was that the electricity generated (not sold) totalled to 8,365,857,198 units, so that the actual increase in the year ended March 31 last was less than 3 p.ct. on the preceding one, notwithstanding that the year covered the coal stoppage, the whole winter with its fuel difficulties and costs, and the period of the Wiring of Homes Campaign. The consumption of coal and coke was over 3 p.ct. more; and the expenditure of fuel oil was also greater.

A Lean Increase.

Loan Repayments.

While the Commissioners have their eyes set on the development of their policy of bulk supply as being in harmony with the scheme for the concentration of generation, they have allowed many plant extensions at existing stations. This was necessary to tide over the period of transition. But the extensions are being made in many cases on more onerous loan terms, which will not be conducive to cheaper current in the immediate years, seeing that, on the old terms, capital charges represented no mean proportion of the total costs per unit. The shortened loan periods now being granted will, of course, be advantageous to the scheme and disadvantageous to the future bulk electricity purchasing undertakings. The past practice of the Commissioners has been to allow a repayment period not exceeding fifteen years where there was reason to anticipate that generating plant was specially liable to be superseded owing to the popularity of bulk supply or otherwise. But with the 1926 Act before them, the Commissioners came to the conclusion that a repayment period of fifteen years would be too long for general application, and that in cases it would be difficult to justify a longer term than ten years. With regard to money borrowed for wiring consumers' premises and the provision of motors, a repayment period of ten years is also to be allowed; and in the case of domestic appliances seven years, subject to the condition that sums in excess of loan repayment received from consumers in discharge of capital liability under hire-purchase agreements shall be applied in reduction of the loan.

The Commissioners Dissatisfied.

While steady progress has been made in taking bulk supply, the Commissioners are troubled over the fact that their policy in this respect has not received a full measure of support. Station managers appear reluctant to give or take a bulk supply; and the Commissioners fear that the idea prevails that, in taking a bulk supply, the status of an undertaking will suffer. The prospective closing of many stations has to be thought of; and, in view of this, the Commissioners urge the recognition of the importance of distribution, and of skilled management being necessary for it and the development of business. This is all very well. With the presence and responsibility of a station with its moving machinery, administrators—be they company or municipal—think much more of the office of engineer and manager than if there is no station—nothing but hidden distribution systems, and business with the consumers. Small wonder that station engineers and managers are dubious as to their future position, and as to the assessment that will be made of their services. The electrical profession will be losing a large slice of its attraction with, ultimately, so few responsible engineering offices available. Another matter over which the Commissioners are dissatisfied is the little progress that has been made towards uniformity of frequency and voltage; and they appeal for whole-hearted co-operation in these respects by the industry.

Cost of Frequency Change.

But that change of frequency is an expensive job is seen by a report of the Manager of the Glasgow Corporation Electricity Department. He estimated that the cost of giving effect to the change, under the Central Scotland Electricity Scheme, in the Govan section of the undertaking alone, will be £285,462. Of this the largest item is a sum of £135,770 for consumers' sub-station requirements. The Town Clerk has been instructed to submit this estimate to the Central Electricity Board, and to request the Board, in terms of the Electricity Supply Act, 1926, to advance, free of interest, from time to time such sums as may be necessary to carry out the scheme. It is calculated that the cost of changing the frequency of the entire Glasgow electricity supply will be upwards of £1,000,000. The proportion that falls on the Department will be met out of revenue, and probably it will be spread over a number of years. Though it is stated that no increase in the price of current is expected to result from the change-over, there is no definite promise in this regard.

Rural Area Tests.

After all that has been said about the supply of rural areas under the great electricity concentration and transmission scheme, it seems that the Central Electricity Board and the Electricity Commissioners are not quite comfortable in their minds regarding it. So much has been urged as to the costliness of transmitting electrical energy into the rural districts in relation to the small amount of business that is likely to accrue, that possibly the two bodies are not so confident regarding the profitableness of the adventure as the political exponents of what was required attempted to persuade the country. Therefore, something in the nature of an experiment appears to be in preparation. A paragraph, obviously inspired, states that a scheme is in hand, and will be completed towards the end of January, to provide for the supply of electricity in certain rural areas. It is pointed out that, when the Electricity Act was passed, it was contemplated that country districts should be supplied with current for lighting and power purposes. It is now stated that, to begin with, this cannot be done on a wholesale scale. The scheme, it is understood, is to apply to a few test areas; and this will enable the necessary experience to be acquired as to the best method of giving rural dwellers a supply.

Aerial Transport and Live Wires.

We are threatened in this country with a great network of overhead electric cables, carried some 80 ft. high in the air. Many millions of pounds will be spent on its provision; and it strikes us as just possible that, when all the work is completed, there may be agitation for the cables to be transferred to subterranean quarters. The erection of cables overhead is not in harmony with the developments that are taking place in aerial transport. In this country two or three airmen have already had narrow escapes from death through their machines coming into close contact with overhead cables; and we seem to recollect one instance in which an airman was killed. Anyway, whether our recollection is right or wrong, Edouard de Lamothe, a well-known French airman, was burned to death during a trial flight at Villacoublay on Dec. 20. He was engaged on a speed trial, when his machine, which was flying low, struck a high-tension electric cable, and took fire. De Lamothe was no doubt killed instantaneously, but before his body could be extricated from the wreckage, it was almost completely burned.

The Long Span.

With the development of the schemes under the 1926 Act, interest is growing in the 80 ft. high towers and the long-span transmission lines between. For safety, we should have imagined the short span would have been better; but it appears that the long span is an economic development. We gather this from an article which Mr. R. C. Andersen has contributed to the "Electrical Review." He tells us that the long span had its origin in mountainous countries; but, with the appreciable rise in material and labour, the long-span vogue has taken hold in countries which, like ours, are relatively flat. Judged solely from the standpoint of low initial capital cost, there is everything to be said for the long span. But only one or two lightning seasons were required to prove that the new construction had grave disadvantages, nor was the trouble located in the insulators; it was in the height above ground at which the conductors had to be erected. The "grave disadvantages," Mr. Andersen says, were found to lie in the direct influence of the height of conductors on the value of induced lightning charges. The higher the towers, the greater the number of "outages" that were experienced due to destructive flashes-over of insulator strings. Altogether the lines weathered the lightning seasons very badly. In this country, relatively speaking, our lightning seasons are innocuous. Nevertheless, the author says, it would be obvious folly were our lines not designed in accordance with the best practice to cope with the ill-effects of induced lightning voltages. Assuming a string of eight orthodox (10 in. diameter) cap-and-pin type insulators as normal for 132 KV., he would like to see a minimum clearance between the lowest conductor cross-arms and ground of 40 ft. Given a 20-ft. minimum clearance between conductor and ground, this would permit of a reasonably long span (600 ft. approximately) with the size of wires generally used on this type of network. A line constructed as indicated would also just release, by flash-over of insulator strings, induced lightning charges created by voltage gradients of 30 KV. per foot. Mr. Andersen next deals with conductor disposition and measures of protection; and, concluding, he remarks: Line height, happily, is under the complete control of the designer; and it is therefore up to him from the start to use sound discrimination in the choice of span length—"Which is more truly economic," he must ask himself, "the long span, with its obvious saving in initial outlay, but possible lightning trouble, or the more expensive, though much more surge-proof medium span?"

Love and Electrical Service.

In a paragraph following Mr. Andersen's article in the "Electrical Review" is a paragraph which conveys a warning to anyone who may be tempted to sit on an overhead cable making love to his sweetheart. The paragraph reads: "Lecturing on overhead transmission lines, Mr. E. Moxon, Electrical Engineer to the Southport Corporation, said that crows were their greatest enemies. They sat on the wires making love to each other; and when they kissed, they caused a short-circuit which put the whole line out of service."

Electricity Workers' Wages.

Electricity workers appear to have very unsettled ideas as to what their labour is worth. New demands are pretty frequent. Just recently members of the Joint Industrial Council for the industry have been in conference at the Ministry of Labour on a programme of demand made by the workers. They asked for 1d. an hour advance, in response to which the employers offered ½d. an hour. It has been agreed to accept the latter; and it is to be given to all employees who are paid according to schedule rates as from Jan. 1—the increase to be in addition to any advance which may then become due under the National Sliding-Scale Agreement. It was further decided that all rates of wages governed by the Schedules and National Sliding-Scale Agreement should be stabilized as from Jan. 1 to Dec. 31, 1928. This will not rule-out any application for the removal of anomalies within a district; and it is recommended that the existing sliding-scale agreement be reviewed in the meantime.

Mishaps.

The good people of Lobbes, near Charleroi (a Brussels correspondent says), have recently had excitement provided by electricity. Rifle shots and the ringing of the tocsin awakened them at 1.30 a.m. on Dec. 20. They saw from their windows a reddened sky, and the overhead electricity cables red hot. On their lights being switched on, the globes burst or the fuses blew; and men running through the streets shouted to the householders to cut-off their supplies at the meters. Two houses were set on fire. It appears that what had happened was that the cable supplying the town came in contact with another running from the generating station. On Dec. 21, the electricity supply failed for half-an-hour in the principal shopping thoroughfare at Oxford. Fort-William depends on water power for its supply of electricity, but the absence of rain and frost-bound conditions have lately deprived the people of the service. On the 29th ult., a serious explosion and fire was caused obviously by a fusion of an electric cable in Albemarle Street, Piccadilly. It appears to have been one of those fairly frequent bitumen gas explosions. Reference to the occurrence is made in our editorial columns. A somewhat similar accident took place last Saturday night in Brook Street, Chorlton-on-Medlock, Manchester—five persons being injured. The inhabitants of the street had a warning that something was wrong by the flickering of the electric lights. Then came the explosion. Bricks and stones were hurled along the pavement, windows were shattered, and an ironmonger's shop was demolished. People who went to the rescue were greeted by a second explosion, and were flung into the street. A fault in the electricity main is "suspected."

THE GREAT GASHOLDER CATASTROPHE IN PITTSBURG.

This account of the occurrence has been kindly contributed to the "JOURNAL" by the Equitable Gas Company, of Pittsburg, to whom we are also indebted for the remarkable photograph [see p. 31] of the destruction that was occasioned.

One of the most unfortunate accidents in the history of the gas industry in Western Pennsylvania occurred when, through some cause as yet undetermined, an explosion took place in a gasholder of the Equitable Gas Company of Pittsburg, Pennsylvania.

A burst of gigantic flame that threw a ghostly red light over the whole city, a roar of greater volume than a thousand Niagaras, a shock like a mighty earthquake, a fiery cloud of smoke that reached the clouds in the heavens, followed the setting-off of gas in the 5 million c.ft. gasholder at 8.43 a.m. on the morning of Nov. 14.

The gasholder had been under repair for about three months and was tested the afternoon of the day before the explosion. No indications of the presence of gas were disclosed by this test. The following morning orders were issued to proceed with the repairs at certain points. The bottom section was partially filled with water, and the holder raised by filling it with compressed air preparatory to repairs. In some unknown manner gas must have leaked into the holder; and an acetylene torch, or some other device used in repair work, ignited the explosive mixture. It is impossible at present to state the exact cause of the accident, but a competent board of experts are probing thoroughly into all phases of the situation to determine it.

When the 5 million c.ft. holder exploded, the flying steelwork, &c., punctured two adjoining holders, one of 6 million c.ft. capacity, and the other of 800,000 c.ft. The gas in these two holders was immediately ignited, and the flames shot high in the air. The blast took a toll of 28 lives and several hundred injured. The property loss has been estimated at from $3,000,000 to $5,000,000.

As soon as details as to the accident were received throughout the city, every effort to provide relief was made. Working crews from the public utility companies were dispatched to the scene. Though practically the entire plant of the Bell Telephone Company, located in that district, was put out of commission for some time, a connection was established near the scene within half-an-hour after the accident. The electric light company strung flood lights, and with the coming of night the district was sufficiently lighted to continue the work of clearing away the débris.

Too much cannot be said about the co-operation lent by many relief workers who remained all night to aid with the work. The police and fire department forces handled the situation promptly and in an admirable way. The Red Cross, the Salvation Army, the Boy Scouts, veterans of foreign wars, the American Legion, volunteer nurses, and employees of industrial concerns worked together to relieve suffering and bring order out of the chaos.

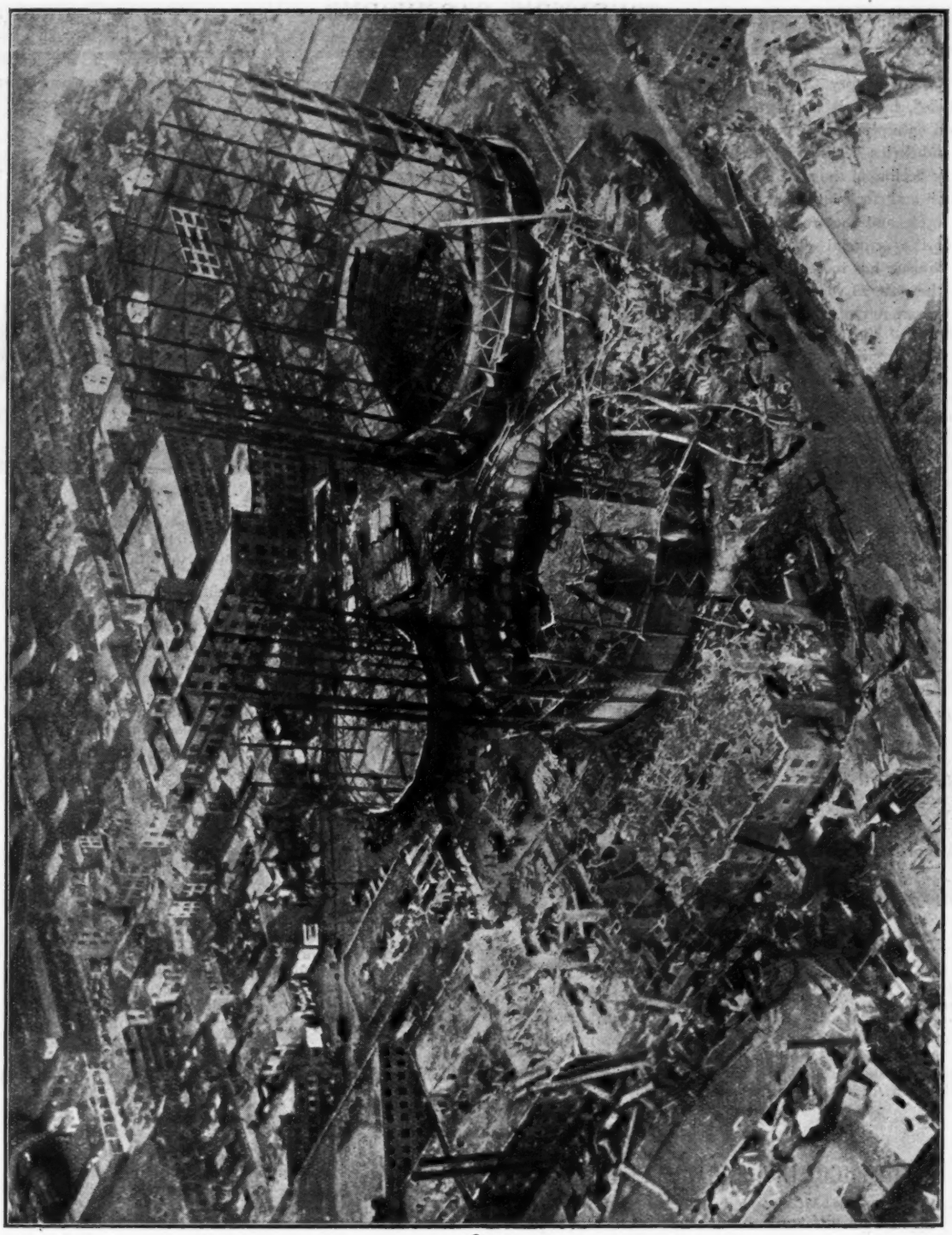
Railway service was restored by 10 a.m. on the morning of the accident, and electric service in that district was restored by evening. Gas service was never interrupted in the explosion area, though in some cases it was discontinued where dangerous conditions existed. After a thorough inspection by their men as to the existence of leaks, the Equitable Gas Company were also in a position to turn gas into the homes which were ready to receive it. No shortage of gas was felt in any district outside of the accident zone.

The telescopic type gasholder is used by the Equitable Gas Company, which type has functioned in the gas industry for about 100 years.

Several days after the explosion, Mr. A. W. Robertson, President of the Equitable Gas Company, announced that the Company would settle immediately all claims for personal injury caused by the explosion, and repair all property damage suffered by home owners and tenants, without taking advantage of legal technicalities. "The industrial losses," Mr. Robertson said, "such as demolition of factories, warehouses, and window breakage in business houses, will be considered later, after the question of legal liability is determined. Many legal questions are involved in fixing the responsibility, and time will be required to decide this matter; but the suffering goes on, homes are wrecked, and the widows and orphans need assistance. We are going ahead to carry out the humane idea, and for this purpose are mobilizing all the resources of our organization. Winter is coming on, and our instructions are that the victims of the explosion must be restored to their former comforts. Our dealing with the people impresses us that they are fair when they know that they are being dealt with fairly. Square dealing will be our principle throughout this effort to restore the losses."

Institute of Fuel.—A meeting of the Institute of Fuel, under the chairmanship of Mr. Frank Hodges (Vice-President), will be held on Wednesday, Jan. 11, at Burlington House, Piccadilly, when Mr. A. B. Scorer will read a paper on "The Utilization of Town's Refuse and Refuse Fuels."

To Prevent Gaskets from Sticking.—A suggestion for preventing gaskets from sticking is put forward by Mr. H. F. Beardmore, of Bartlesville (Okla.), who says, in the "American Gas Journal," that trouble is frequently encountered when attempting to remove gaskets after they have been in service for several months. The usual practice is to put oil or cup grease on the gasket before placing it in the flange. This is satisfactory, and prevents for a while the trouble caused by sticking; but in gas lines this practice is not effective after a short time in service. One plan that has been tried and has given perfect satisfaction in preventing sticking of gaskets is to cover the gasket, flange, and disc face with a rust-preventing grease every time the gaskets are installed. This absolutely prevents the gaskets from sticking, even after long service, and in the worst conditions.



A REMARKABLE PHOTOGRAPH OF THE DEVASTATED AREA IN PITTSBURG.

THE "SANDWICH" SYSTEM.

Experiences in Germany.

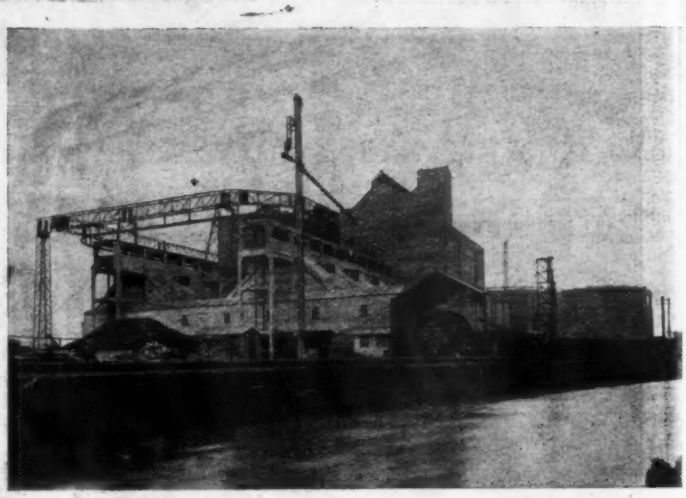
As not infrequently happens, the practical and economic value of British inventions finds greater appreciation in foreign countries than in their native land. Although adopted in many important electric and colliery power stations in this country, the patent "Sandwich" system is no exception. On a cost and efficiency basis, the economic results obtained with this system are, so far, not appreciably less than those obtained with pulverized fuel. These reflections are prompted by a reference in our contemporary "Combustion" to this year's report of the Ruhr Collieries Boiler Inspectors' Association. Among other things, allusion is made to the experiences of German boiler furnace builders in trying to apply American practice in underfeed stoker development to German conditions; they were not altogether successful, because of the peculiarities of the specific Westphalian blends of coal, which are strongly caking. To force combustion to a degree easily possible with American bituminous, may become dangerous practice with coals containing ash of slightly lower fusing temperature. This again would prove that it will not do simply to apply methods of combustion which have been successful elsewhere. No wonder that with these difficulties to be met, the report goes on to say that the underfeed stokers require more attention and labour than standard travelling grates. The latter, on the other hand, when used with lean or anthracite coal, did not uniformly make good. While lean coal with about 12 p.ct. volatile burned comparatively well in a series of special tests, anthracite would show an insuperable tendency to open up free spaces in the fire bed when forced draft was used, and to emit too high percentage of half-burned fines. A decided success, however, was scored in burning coke of various grades on travelling grates after suitably adjusting the ignition arches and regulating the draught. The so-called "Sandwich" system of feeding on the travelling grate two layers—coke (underneath) and rich coal fines (above)—has been made a success, following the British example.

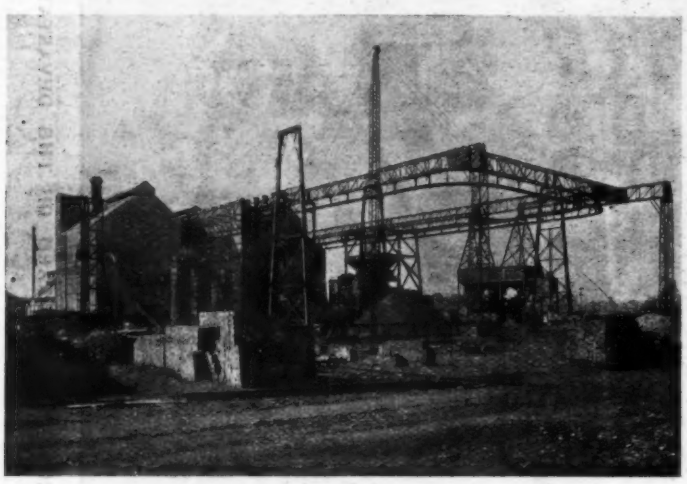
COVENTRY GAS-WORKS.

[Extract from "West's Gas."]

In its long history Coventry experienced many vicissitudes, but it is a tribute to the resourcefulness and enterprise of its people that when certain staple industries declined, others were introduced. With the decline of the cloth and ribbon trade came the watch and clock industry, to be followed in turn by the cycle and motor trades, also the establishment of the artificial silk industry. The population of the city has increased from 70,000 to 139,000 during the past 28 years.

In 1820 an Act of Parliament authorized the incorporation of the Coventry Gas Light Company, which was acquired by the Corporation in 1884. These works were situated in the city on a site of only 4 acres; the manufacture of gas being discontinued there in 1909 on the completion of the Foleshill Gas-Works on a site covering 50 acres. The following figures illustrate the rapid development of the undertaking during the past 20 years.





	1907.	1927.
Gas sold, c.ft.	795,378,300	2,115,383,800
Consumers	16,167	40,133

The quantity of gas used for industrial purposes in Coventry in the heat treatment of metals, &c., amounts to 40 p.ct. of the total output—a number of firms consuming upwards of 50 million c.ft. of town gas per annum.

The manufacturing plant at the Foleshill Works comprises horizontal retorts (capacity 4¼ million c.ft. per diem), and carburetted water-gas plants (two sets each of 1 million c.ft., and another 1½ million set just completed, together with a waste-heat boiler). These plants were constructed by Messrs. Humphreys & Glasgow, Ltd.

There are now two installations of Glover-West vertical retorts. The first was completed and started up in March, 1923, and comprises nine settings of eight retorts each, 33 in. by 10 in. by 21 ft. long. This installation has more than fulfilled the expectations of the Corporation's Gas Engineer in its performance during the past 4¾ years. The capacity of this section is 3 million c.ft. per diem. Except for minor repairs in 1926, the retorts have worked continuously, and it is intended to run them until the summer of 1928.

The second installation was completed and brought into commission in November, 1927, and comprises five settings, each of eight retorts of the latest 40-in. type, 25 ft. long, with special steaming section. Two Spencer-Bonecourt boilers are provided for the recovery of the waste-heat from this installation. The output from the five beds is 3,400,000 c.ft. per diem; and provision is made for a further four settings to be added at a later date.

The ground space which will be occupied by the nine settings of the larger retorts will have exactly the same area as that occupied by the nine settings of the smaller retorts in the No. 1 installation, whereas the daily output of gas will be doubled. This economy of ground space is a valuable consideration to an undertaking developing at a rate of 6 p.ct. compound, or doubling its sales of gas every 12½ years.

FORTHCOMING ENGAGEMENTS.

Jan. 7.—WALES AND MONMOUTHSHIRE JUNIOR GAS ASSOCIATION.—Meeting in Cardiff. Paper by Mr. R. P. Jones, on "Residuals."

Jan. 7.—WESTERN JUNIOR GAS ASSOCIATION.—Visit to the works of the Bath Gaslight and Coke Company. Papers by Mr. W. L. Ashman on "Water Softening," and by Mr. H. C. Feltham on "The Future of the Gas Engine."

Jan. 10.—NATIONAL GAS COUNCIL.—Meeting.

Jan. 10.—FEDERATION OF GAS EMPLOYERS.—Meeting.

Jan. 14.—SCOTTISH JUNIOR GAS ASSOCIATION (WESTERN DISTRICT).—Joint meeting with Eastern District in Edinburgh. Paper by Mr. J. G. Davidson, entitled "Organization in Theory and Practice."

Jan. 14.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Visit to the Waddon Works of the Croydon Gas Company.

Jan. 18.—ROYAL SOCIETY OF ARTS.—"Methods of Radiant Heating." By Mr. A. H. Barker, B.Sc., M.Inst.C.E. 8 p.m.

Jan. 19.—MIDLAND JUNIOR GAS ASSOCIATION.—Meeting in Birmingham. Paper by Mr. D. J. Ward on "Odds and Ends about a Gas-Works."

Jan. 21.—YORKSHIRE JUNIOR GAS ASSOCIATION.—Meeting in Bradford. Lecture by Mr. H. R. Hiscott (Le Bas Tube Company, Ltd.) on the "Manufacture of Malleable-Iron Pipe Fittings, Wrought-Iron and Steel Tubing, &c."

Jan. 26.—MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—Jubilee dinner, followed by cabaret, at the Queen's Hotel, Birmingham.

Jan. 27.—LONDON AND SOUTHERN DISTRICT JUNIOR GAS ASSOCIATION.—Meeting at the Westminster Technical Institute. Paper by Mr. F. M. Birks, O.B.E., on "Notes on the Mechanical Work at the Beckton Station of the Gas Light and Coke Company."

Jan. 28.—SCOTTISH JUNIOR GAS ASSOCIATION (WESTERN DISTRICT).—Visit to the Provan Chemical Works, Glasgow.

INSTITUTION OF GAS ENGINEERS.

Jan. 9.—Emergency Committee. Finance Committee.

Jan. 10.—Gas Education Executive Committee.

Carbonization Conference.

The Conference will be held in Birmingham, at the Midland Institute, from Feb. 21 to 24, under the joint auspices of the Coke Oven Managers' Association, the Institution of Gas Engineers, and the Society of Chemical Industry; and the Institute of Fuel have joined the Committee. There will be a visit to the British Industries Fair on Wednesday, Feb. 22, and an inspection of one of the gas-works on the Thursday. A luncheon at the Fair will be given by the management on Feb. 22. An extensive programme of papers has been arranged; and regarding these we will give information later.

The Parkinson Stove Co. Ltd

A Word in Season

By

Greetings

1928

WE hope that the happy associations which have existed for many years between us and our friends in the Gas Industry may be developed and considerably extended during the coming year, so that they and we may enjoy a Happy & Prosperous New Year

Birmingham, London etc.

the "Regulo" (Regd.)

¶ The perfect simplicity of the "Regulo" in the "New World" Cooker and its unfailing reliability under all conditions of pressure or supply, open up enormous possibilities in the direction of extending the use of Gas for cooking. The proved dependability of the "Regulo," together with the other advantages of the single burner with direct bottom-flue-outlet (introduced by Radiation Limited), has given the Industry its most potent means of meeting successfully the competition from other fuels. No other cooker has the same popular appeal as the "New World."

Radiation
LIMITED

"New World" Regulo-Controlled Oven

with the SINGLE BURNER and Direct BOTTOM-FLUE-OUTLET

Only with "New World" Ovens do you obtain:

1 *Complete circulation of the hot gases throughout the whole of the cooking space and the avoidance of hot spots.*

2 *Uniform cooking with the oven fully loaded.*

3 *Greatly increased oven capacity.*

4 *Reduced gas consumption.*

5 *Higher quality of cooking than in any other type of oven.*

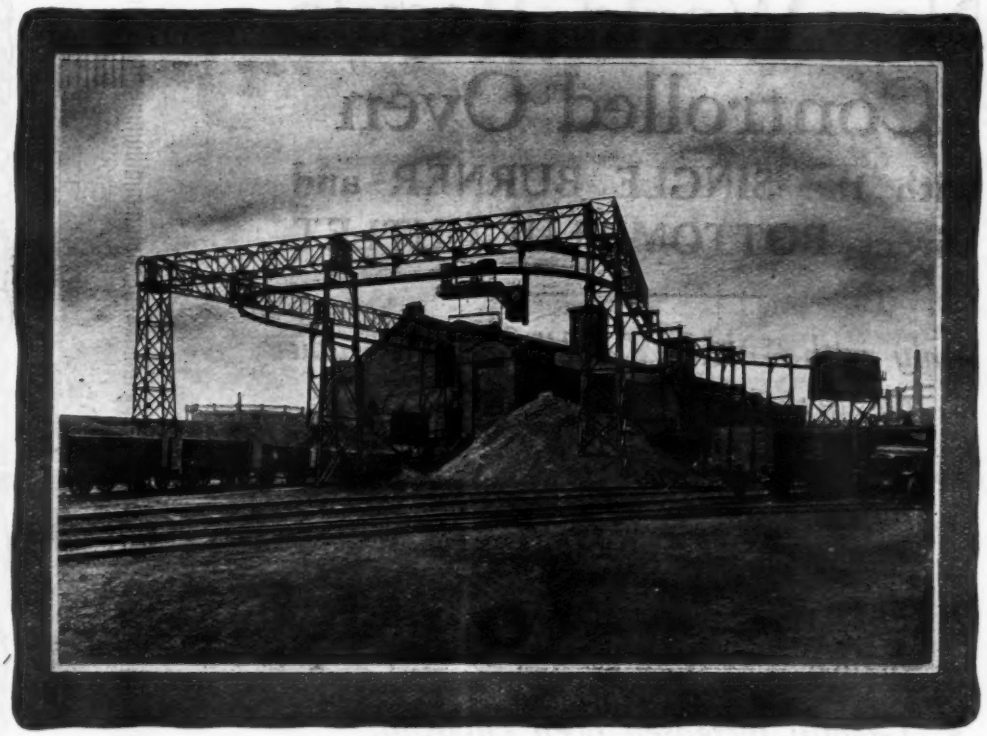
6 *Elimination of all possibility of smothering, or accidental extinction of the burner flames from any cause whatsoever.*

7 *Reliable automatic oven-heat control.*

¶ **The "New World" Cooker is establishing for gas an unassailable position.**

Service and Thoroughness

SOME OF OUR CONTRACTS



IN this Telpherage Plant for coke handling there is included a set of Coke Storage Hoppers and "Cascade" Screening Plant (seen in the distance), together with a Shelter for the Telpher Machine at the extreme end of the track.

Our contract comprised nine beds of 10 Retorts 24 ins. by 18 ins. by 23 ft. long, built in an existing House and, in addition, embodied Coal Plant, Drakes' Patent Stoking Machine and the Coke Plant mentioned above.

Telephone: 2741 Halifax (5 lines) (Day and Night)
Telegrams: "Drakeled, Halifax"

Drakes Limited
HALIFAX
YORKS

Special Address for Night Telegrams: "Phone from Leeds, Drakeled, Halifax 2741"

150-247

CAKING OF SULPHATE OF AMMONIA.

By W. G. ADAM,

Superintendent of the Gas Light and Coke Company's Tar and Ammonia Products Works, Beckton, London, E. 6.

In the days of grey acid sulphate of ammonia, the problem that confronted the exporters at first was that when it reached its destination the bags in which it was packed were found to be so rotted by the acid in the sulphate that they fell to pieces on attempting to lift them from the holds. This led to the adoption of the practice of double bagging for export, which added considerably to the expense. Shippers, therefore, naturally hailed with delight the advent of neutral sulphate, in that henceforth single bags would suffice, and the cost of bagging be practically halved. Their enthusiasm was but short-lived, for another trouble evidenced itself. The bags of sulphate arrived intact, but were caked in a cement-like form that required sledge hammers to reduce the sulphate again to a condition easily distributable on the soil.

Various theories were advanced to account for this; but it was not until the British Sulphate of Ammonia Federation appointed a Committee to investigate the matter that makers of dry neutral sulphate of ammonia were able to overcome the difficulty. A large amount of the work which this investigation necessitated was carried through by the Gas Light and Coke Company at their Products Works, Beckton, and was made available to the Committee; the subsequent recommendations of the Sulphate of Ammonia Federation being based on the information thus obtained. These recommendations have been faithfully carried out by several large makers; and the product shipped abroad by these makers has given no trouble with caking.

The work carried on at Beckton prior to June, 1925, showed that the caking was mainly due to loss of moisture; but it was also considered that the size and form of the crystal, and probably other factors, might bear on the problem. It was shown that caking was caused by small crystals being formed when the moisture was evaporated. The moisture is present as a saturated solution of sulphate of ammonia; and any subsequent drying causes the binding together of the large crystals by the formation of small crystals around the points of contact.

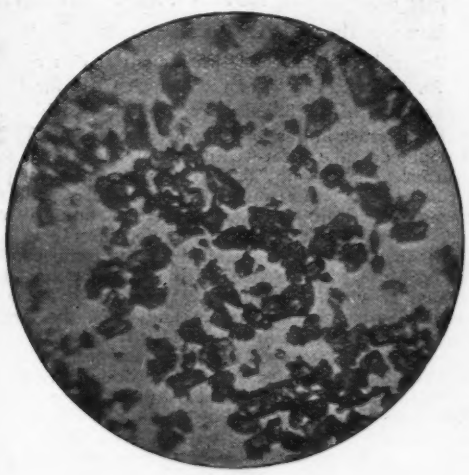
It therefore seemed probable that if a method could be devised for determining the area of contact in a particular make of sulphate of ammonia, it would give us a measure of the caking tendency of that particular make. One would expect that the larger the area of contact the greater would be the tendency to cake, and *vice versa*. It appeared that, by measuring the free space, or voids, between the crystals, a value bearing some definite relation to the area of contact would be obtained.

Several methods of determining the voids were tried, the one finally adopted being as follows: A standard 100 c.c. cylinder was filled to the mark with the sample under examination, and paraffin slowly run, from a standard burette, into the cylinder containing the sulphate until the 100 c.c. mark was reached. The quantity of paraffin used gave at once the percentage of voids. It was found that the figure thus obtained agreed very closely with that calculated by determination of the apparent and real specific gravities.

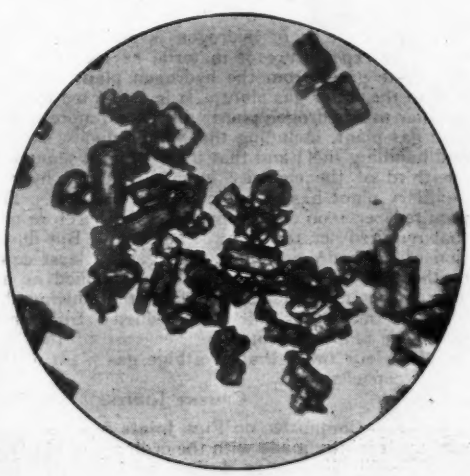
The determination of voids and the grading of various makes of sulphate of ammonia gave the following results:

Make.	Voids, P.Ct.	Grading.			
		+ 40.	− 40 + 60.	− 60 + 100.	− 100.
Beckton special large	61·2	96·3	3·0	0·5	0·2
Beckton ordinary stock	53·5	6·4	54·0	35·2	4·4
Gas-works M	51·9	22·6	54·6	22·4	0·4
Coke-oven works B.	50·7	0·6	27·6	64·5	7·3
Coke-oven works A.	50·0	28·3	58·0	12·5	1·2
Synthetic G	43 5	76·0	20·1	3·6	0·2
Synthetic B	43·0	80 0	18·6	1·4	*Nil*
By evaporation of sulphate of ammonia solution S	42·0	91·7	7·4	0·9	*Nil*
Gas-works S	41·0	56·5	39 0	4·5	*Nil*
Sulphate finely ground in a mortar	39·5	*Nil*	*Nil*	*Nil*	100
By evaporation of sulphate of ammonia solution B	36·5	56·9	33·0	9·5	0·6

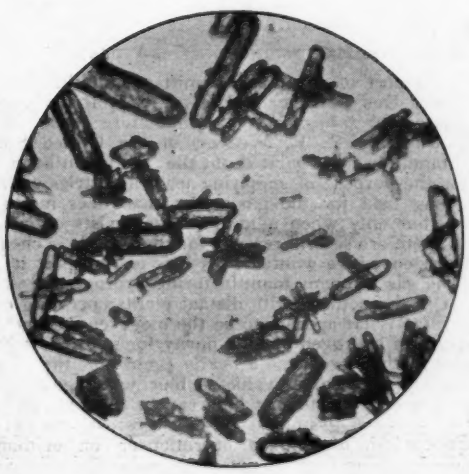
Beckton Special.



Synthetic G.



Synthetic B.

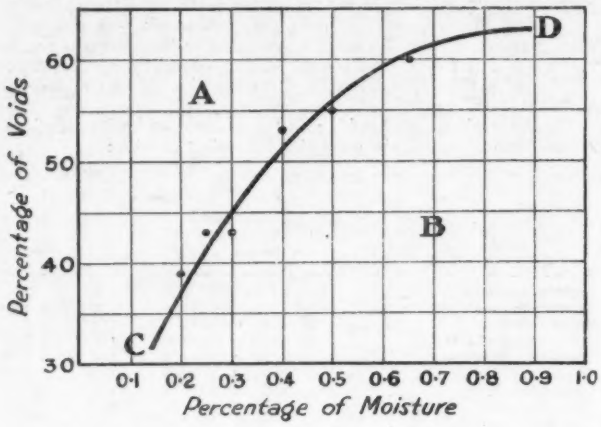


Beckton Ordinary.

It will be noted from this table that there is no relationship between the grading and the percentage of voids.

In order further to test the theory that the caking tendency was largely dependent on the percentage of voids, the following method of testing the "cakeability" of the sulphate was used: Small canvas bags 2 in. by 4¾ in. inside measurements, and holding about 60 grammes of sulphate of ammonia, were pressed while being dried at 100° C., between iron plates bolted together. A sample of sulphate of ammonia having 60 p.ct. voids was taken and subjected to the above treatment, with slightly increasing percentages of moisture until the sample definitely caked. This was found to occur when the percentage of moisture was 0·65 or above; below this percentage no caking occurred.

This process was repeated with other makes of ammonium sulphate; the results being illustrated by the following curve:



When the conditions lie within the area A—that is, above the line CD—the crystals of sulphate of ammonia will not cake; and with conditions coming within the area B, the product will cake—the line CD representing the points at which caking actually occurred.

The results obtained showed that immunity from caking is not guaranteed by the production of a large crystal, neither is trouble to be anticipated purely on the grounds of the crystal produced being small; but the percentage of voids, on which the size and grading of the crystal have practically no bearing, is a true indication of the "cakeability" of the sulphate of ammonia.

As the percentage of voids depended largely on the shape of the crystal, makers should aim at producing the long needle form, which gives the greatest percentage of voids.

The large crystals, formed by the evaporation of sulphate solutions, such as are used in the manufacture of the synthetic product, have a low percentage of voids, and evidently fit closely together, giving, therefore, a sulphate which cakes readily. These synthetic crystals are in the form of short hexagonal prisms, the length of which is practically equal to the diameter, whereas the sulphate of ammonia of good quality made in a saturator by the ordinary means from gas liquor has a length equal to from eight to ten times its diameter. This point is well shown by the microphotographs [p. 33]; the magnification being equal (about 25 diameters) in each case.

The reason for the greater percentage of voids in the needle crystals is then fairly easily accounted for. In the case of the short, almost cubical type, the crystals mass together quite closely, without deliberate arrangement; whereas the long crystal would only fit closely when arranged in an orderly manner, after the style of matches in a box.

It will thus be seen that the recommendation of the Sulphate of Ammonia Federation that the moisture content should not exceed 0·2 p.ct. is fully justified by the curve, which shows this value to be within the safety limits for the present-day makes of sulphate.

AMERICAN GAS ASSOCIATION.

NOTES FROM REPORTS AND PAPERS.—Third Article.

Outstanding Heat-Treatment Installations.

In connection with the report of the Industrial Gas Section Committee, Mr. Hale A. Clark, of the Detroit City Gas Company, considers some of the industrial operations in which the most significant increase in gas load has occurred. The first of these is undoubtedly the heat-treatment of steel. At Milwaukee, a furnace 195 ft. long, able to handle 25 tons of product each 24 hours, has just completed a successful year in the "malleableizing" of iron castings. A second unit is now contemplated. At 1750°, the fuel consumption is only 1¼ c.ft. per pound. Again, Chicago has installed a large compensating type carburizing furnace at the plant of the International Harvester Company, at which plant other major uses of gas have been developed. Syracuse has what is said to be the largest continuous carburizing furnace in the world. It is 385 ft. long. At Toledo, twenty-four continuous furnaces have been in operation six months; and other furnaces of like design are under installation. All of this equipment is at the plant of the Willys-Overland Company. The operations include annealing, hardening, carburizing, and billet heating for forging. The monthly gas consumption is 60,000,000 c.ft. In Detroit, the gas used for steel heat-treating has increased from 40,000,000 to 85,000,000 c.ft. per month—and this in a year of comparative slackness in business, as well as in the face of a formidably entrenched electrical situation.

Hydrogen Manufacture at Gas-Works.

Part of the report of the Sub-Committee on Utilization of Off-Peak Water Gas Capacity and Extra Capital Investment Required was on the subject of the manufacture of hydrogen. The writer was Mr. E. R. Weaver, of the United States Bureau of Standards, who pointed out that the manufacture of hydrogen for the purpose of supplying local industries offers a more promising field for the gas-works than does methanol manufacture, but only when a local market exists or can be developed. There are several reasons for this: (1) It is cheaper to make hydrogen where wanted than it is to transport it any distance. The gas company manufacturing hydrogen locally is therefore not in competition with distant plants operating on a larger scale. (2) What appears to be the most feasible method of manufacture of hydrogen of high purity for use at low pressure produces at the same time a nearly equal quantity of gas of approximately the heating value of blue water gas, and a considerable quantity of steam which can be used simply and effectively in the water gas plant. (3) The process does not require a different kind of technical operation or control than is usual in gas plants, and would not make necessary a specially trained personnel or an additional laboratory. (4) In an emergency which justified cutting-off the supply to the hydrogen customers, the whole of the hydrogen plant could be utilized, with very little delay, as an auxiliary plant for supplying carburetted water gas.

The system of making hydrogen suggested is a modification of the familiar "steam-iron" process which is known in various modifications as the Lane process, the Messerschmidt process, &c. Iron oxide is reduced by blue water gas, and the resulting mixture of iron and ferrous oxide is used to react with steam to produce hydrogen; the iron going back to its original state of oxidation, and completing the cycle. The reactions may be carried out in a refractory-lined shell similar to that of a water gas carburettor or superheater. The mixture of iron and iron oxides may be kept at the most favourable temperature for the reaction (about 800° C.) by preheating the gases introduced. The waste heat of the water gas blast may be used for this purpose in a recuperator. While reducing the iron oxide, a part of the carbon monoxide and hydrogen of the water gas are oxidized to carbon dioxide and steam. Chemical equilibrium and the necessity for maintaining a reasonable rate of production prevent the oxidation of more than about half of the carbon monoxide and hydrogen. Steam is one of the raw materials of the water gas process, and carbon dioxide is nearly as good for the same purpose. It is therefore possible efficiently to utilize all the constituents of the spent reducing gas by the simple process of returning this gas to the blue gas generator during the run.

Now, 1000 c.ft. of hydrogen is obtained for practically the same net expenditure of material as 1000 c.ft. of blue gas, if the waste gases from the hydrogen plant are returned in this way to the water gas plant. It is estimated that the equipment peculiar to a hydrogen plant will cost no more than the auxiliary blue gas plant, including that for producing steam and storing and handling fuel; and that the combined plant will have about one-third of the capacity in cubic feet of hydrogen that the auxiliary plant has in cubic feet of blue gas. The investment required per 1000 c.ft. of hydrogen is therefore about six times that required per 1000 c.ft. of blue gas. But during the operation of the hydrogen plant, blue gas, at least equal in amount to the hydrogen produced, will be supplied as a bye-product. The cost of the usual equipment for producing this amount of blue gas may thus fairly be deducted from the cost of the hydrogen plant, leaving the net cost of the hydrogen plant equal to four times that of a blue gas plant of the same volumetric capacity.

Cement Joints.

The Sub-Committee on Pipe Joints reported that the number of cement joints, made with the ordinary or old type of bell, has been steadily increasing during the last 25 years. They have been successfully used to a limited extent even for a longer time; and the splendid record obtained by those who have had

the greatest experience with them has demonstrated beyond question their value under general low-pressure conditions, and in sizes 12 in. and under. It must be borne in mind, however, that where mains must of necessity be laid during very cold weather or under conditions where excavations must be filled in immediately, or where the mains are laid through running sand, quicksand, or under very wet conditions, the lead joint possesses many advantages. While the theory of the cement joint seems to show that the factor of safety approaches unity when sizes of 10 and 12 in. are reached, there are many locations where, owing to climatic conditions, the stresses set-up in the joint will be less than those hitherto assumed; and under such conditions cement joints will prove satisfactory, when properly made, even in sizes larger than 12 in.

One large company, having 1000 miles of mains laid with cement joints and 438 miles laid with lead joints, reports one cement joint leaking for every 12 miles of main, and one lead joint leaking for every 0·78 mile of main. Another company, with approximately 550 miles of mains laid with cement joints, showed only one low-pressure leak during the year 1926. As a protection against electrolysis, the all-cement joint is probably the most efficient; but the fact that a main does not carry current does not mean that the service will not be subjected to damage, as the current may flow from the water main to the gas service via the connection at the water heater.

The cement joint, while not new, is still comparatively novel, and has been adopted but slowly. The reason for this may be found in the fact that this joint was the first of the rigid joints to be used with bell-and-spigot cast-iron pipe. The joint depends for its tightness not upon its ability to allow motion without leaking, but upon its ability to hold the pipe motionless in the face of the various strains to which the pipe is subjected. The bond of the cement to the iron is what makes the joint tight, and gives it strength. For this reason, it is advisable to put as little yarn and as much cement into the joint as possible. The use of too much water in the cement, causing abnormal contraction of the cement when it sets-up; failure to bed the pipe properly and partially to back-fill before making-up the joint; failure to protect the finished joint from the sun; and the use of cement that has already partially set-up, are all sources of possible trouble that have to be guarded against in making-up a tight cement joint. Tests have been frequently carried out which show that a well-made cement joint will stand more than 60 lbs. pressure.

Window Displays.

In the United States a few years ago there were less than half-a-dozen gas companies who made use of window displays. To-day, however, there are hundreds of companies all over the country who have put to work the great sales force of display advertising. There can, say the Committee dealing with the subject, be only one reason for this great growth—display advertising has paid. At a later date it is intended to publish a manual for the assistance of gas undertakings. Meanwhile, sketches are in preparation for a series of displays which will be rented to member companies for a nominal fee. Six displays of this type have been carefully worked-out according to the best practices of window display. They will not only furnish ideal examples after which companies may model displays of their own, but they will enable the smaller companies, and those not using displays at the present time, to have for a low rental fee a series of displays worthy of the windows of the largest metropolitan company. The services of the Window and Store Display Committee are available gratis to member companies.

Customer Ownership of Stock.

Stock sales under the customer ownership plan were undertaken by 91 American gas companies during 1926; the total volume being $120,877,273. These are big figures; and they grow year by year. The system is, report the Committee on Customer Ownership, building-up a new investing class. The ten cardinal principles of customer ownership have been stated by the National Electric Light Association as follows: (1) The sale of the securities must be direct from company to customer, or through an agency expressly created for the purpose and controlled by the company. (2) The safety of the securities offered must be amply protected by property and earnings. (3) A minimum rate of dividends must be provided for in so far as honest judgment based on experience can foresee. (4) A reliable re-sale market must be maintained in some manner, so that shareholders who wish to dispose of their holdings can do so promptly at nominal expense. (5) A partial-payment purchase plan must be operative, in order to give every customer who can save a small amount monthly full opportunity to become a shareholder, and to encourage thrift. (6) The proprietary interest and responsibility of shareholders must be emphasized, and the shareholders supplied regularly with information regarding their company and its affairs. (7) Loss of capital by shareholders in hazardous and fraudulent offerings from various sources must be guarded against by the rendering of authentic information and advice to shareholders. (8) The number of shareholders must be increased steadily; and efforts should be made to avoid large individual accumulations of stock. (9) Employees must be carefully instructed, in order that all representations made to customers or others are in line with the facts. (10) Managements must realize that customer ownership multiplies their obligations to the public and intensifies the trust reposed in them. It does not replace the constant striving for higher efficiency, good service, reasonable rates, courtesy, and a progressive public relations policy.

The Committee conclude their report by remarking that customer ownership of stock has supplied millions of dollars in the past; more millions are required to make the best of the great days ahead. "Where can we better go to obtain these millions than direct to the householder and the manufacturer who uses our product? The confidence built up by customer ownership in the past will serve us well in the future; and for that reason an even broader customer ownership programme must always remain one of the bulwarks of our future expansion and success."

Wrongful Connections to Service Pipes.

In view of the fact that illegal connections for the purpose of obtaining wrongfully a supply of gas are, as a rule, cleverly concealed, and are usually discovered by wide-awake employees, a Sub-Committee on Meter Reading Practices recommend the payment of a cash reward to meter readers for the discovery of "false connections," because such a course offers an incentive to the readers to be on the alert in looking after the company's interests.

HOUSE HEATING FROM A CENTRAL STATION.

An Undertaking in Paris.

In our Editorial Notes on Dec. 21 last (p. 802), mention was made of the projected distribution of steam heat in a district of Paris. Our esteemed contemporary, "Le Génie Civil," in its issue for Dec. 17 gives full particulars of the concession granted to the "Compagnie Française de Chauffage Urbain," sketches the history of this by no means new method of distributing heat, and discusses the present project. Details of the working of a possible competitor will doubtless be of interest to our readers.

It is intended that the heat shall be distributed in the form of steam at a pressure of 3 to 4 kg. per sq. cm. [43 to 57 lbs. per sq. in.]. Steel pipes will be used, the mains being laid in galleries, and the secondary mains and branches in conduits; and each steam pipe will have the return condensation pipe laid alongside it. To start with, the Company's generating station will be the old Bercy Works of the Metropolitan Railway, which the Municipal Council have decided to sell owing to high running costs. The plant will provide the Company with some 135,000 kg. [297,000 lbs.] of steam per hour; and with this they propose to serve the eastern district of Paris. The price asked for the Bercy Works and plant is 5½ million francs [about £44,350 at the present rate of exchange].

The distribution system may later be linked up with the Saint Ouen and Issy-les-Moulineaux stations of the Paris Electricity Company, which only for a brief daily period utilize the full output of their boilers. At off-peak times a considerable quantity of steam will thus be at the disposal of the Heating Company. It is also anticipated that use will be made of the waste heat from sewage works and gas-works; and the development of dry coke-cooling at the latter is envisaged now that an outlet for further surplus steam is in sight.

Our contemporary reprints the majority of the Articles of the concession, which show that the Heating Company are to have a monopoly until the end of 1935, but that at least 6000 metres of main are to be laid within five years. The price chargeable per thousand major calories will be fixed by the Prefect of the Seine, and must not exceed the cost of heating by means of a normal house central-heating installation.

The supply of heat is to be continuous from Sept. 15 to May 15, save that a maximum of two days per month will be allowed for inspection and repairs. Either hot water or steam may be distributed. If the former, it must reach the service at the minimum temperature of 60° C.; if steam is the medium employed, it must be supplied at an effective pressure of not less than 100 grammes per sq. cm. [1·42 lbs. per sq. in.] at the meter. [Metering of the consumption works on the principle of measuring the condensed water.]

Methods of Radiant Heating.—This is to form the subject of a paper which Mr. Arthur H. Barker, B.Sc., M.Inst.C.E., will present to the Royal Society of Arts, John Street, Adelphi, on Wednesday, Jan. 18, at 8 o'clock.

NOTES ON NEW BOOKS.

GAS-FIRED STEAM BOILERS.*

The science and the art of steam raising and utilization are at present in course of rapid transition and development. There is insistent demand for improvement in efficiency and control, and for smaller as well as larger units. Recently the output of individual boilers has been raised to some 270,000 lbs. of steam per hour; and there has been growing application of solid fuel in pulverulent form, in order to ensure complete and almost instantaneous combustion. In the United States of America, powdered-fuel boilers far in excess of this output are not uncommon. On the other hand, in the application of steam to heating and process work of a specialized and intermittent description, where automatic control of a thoroughly reliable character is imperative, the demand has been for quick-steaming units of small but rapid output, capable, on occasion, of giving delivery of 100 to 300 p.ct. in excess of normal rating. This demand, often coupled with the need for freedom from dust, dirt, or grit-laden effluent, has necessitated the use of fuel in fluid form; and in these circumstances prospective users, not unnaturally, turn to oil. On a cost and efficiency basis, imported oil fuel, *per se*, can seldom show to advantage when compared with our native solid fuel coal; and in an oil-bearing land such as the U.S.A., manufactured gas in successful competition with oil appears to be absurd. It was, therefore, both refreshing and encouraging to hear from an eminent American gas engineer, on a recent visit to this country, that in his home-town gas was in certain circumstances supplanting oil for both heating and steam raising; the reason, briefly stated, being greater reliability and flexibility of control. The implied unreliability of automatic oil firing apparatus, and the damage due to the escape of the tarry products of incomplete combustion of oil, constitute the all-sufficient reasons for the change. To have this statement amplified and confirmed in such concrete form as that contained in the latest American publication on gas-fired steam boilers is therefore doubly gratifying, as it tends to show that, a considerable measure of success having already been attained where competition is infinitely greater, there should be in this country a great field for the successful application of the gas-fired boiler.

This comprehensive work has been prepared under the supervision of the Committee on Steam Boilers, and is the product of the Industrial Gas Section of the American Gas Association. It is divided into seven chapters and two appendices, A and B; the latter being a list of forty different industries which are said to be large users of gas-fired boilers. The specific applications are enumerated for each individual case given in the list, which includes many applications with which we in this country are familiar, and several which are not only new, but suggest considerable possibilities—such as motor car cleaning and paint removing.

A list of gas-fired boiler makers is also given, which includes the names of some 34 British and American manufacturers of both high and low pressure units. Chapter 7 is a survey of existing industrial installations, profusely illustrated, which is of particular interest to those cultivating this branch of special gas sales. In the other chapters there have been collected data and information appertaining to boiler design, construction, care, and management, which are rarely to be found within the compass of one volume. The all-important matter of feeding and feed water treatment is not overlooked.

Instances of gas-fired boilers working in conjunction with oil-fired units are given, and also cases where both internally and externally fired boilers of relatively large capacity have successfully been converted from coal (or oil) to gas firing.

In an introductory preface to this important work, the editor remarks that the load due to gas-fired boilers is not only already a large one, but that it has been found in its incidence to have most favourable characteristics in regard to load factor. One firm of boiler makers estimates conservatively that more than 115 million c.ft. of annual sales are directly attributable to its own make of gas-fired boilers in use in one moderately-sized industrial community. These remarks, coupled with the fact that gas-fired steam boilers are already standardized and built in a limited number of stock sizes with completely interchangeable parts, augur well for the future. The book should be in the hands of all interested in this important branch of industrial gas sales, as well as of all users of gas-fired steam boilers.

* "Steam Boilers: A Reference Book on the Application of Gas to Steam Boilers used essentially for Industrial Purposes." Published by the American Gas Association, 420, Lexington Avenue, New York. Price $1·50 to members of the American Gas Association.

CHEMICAL STUDY OF PROCESSES INVOLVING THE CARBONIZATION OF COAL BY INTERNAL HEATING.

By Prof. MORRIS W. TRAVERS, F.R.S.

[Paper before the Institute of Fuel, Nov. 24, 1927—Mr. J. TERRACE, M.Inst.C.E. (Chief Engineer of the South Suburban Gas Company, and a Vice-President of the Institution of Gas Engineers), presiding.]

INTRODUCTION.

The distillation of bituminous coal by the action of hot gas or vapour forms the basis of industrial processes which have for their object either carbonization of the fuel for the production of coke or semi-coke, or the complete conversion of the fuel into gas. The process also takes place in the fuel bed of every industrial furnace which is fed with coal; the fuel in the middle and upper layers of the fuel bed being heated mainly by the hot gas generated in the lower layers. However, when the fuel bed is only a few inches in thickness, the regions of gasification and carbonization are not sharply distinguished, though it is now generally recognized that the process of combustion in a furnace fed with bituminous coal takes place in three stages:

(*a*) Gasification of the coke by primary oxygen, which is entirely consumed in the extreme lower layers of the fuel bed, and is mainly converted into carbon monoxide.

(*b*) Distillation of the fuel by action of the hot gas.

(*c*) Combustion of the gas by secondary oxygen admitted above the fuel bed.

When the fuel bed is deep, as in the gas producer, the differentiation of the gasification and distillation zones becomes more marked; and when the process of combustion is removed to a distance from the region of gasification, it becomes possible to consider the thermal changes in the process of gasification entirely apart from those involved in the combustion of the gas. From the thermal analysis of the changes taking place in the fuel bed of the gas producer operated under varying conditions, much information has been obtained in connection with the gasification of solid fuel by "internal heating."

From the thermal standpoint we may consider the changes in the gas producer as taking place in a single stage, or in two stages. In accordance with the first method we can compile a thermal balance sheet as below:

Gross calorific value of fuel	Q_1	Sensible heat of gas	Q_6
Sensible heat of fuel	Q_2	Gross calorific value of ashes	Q_7
,, ,, ,, air	Q_3	Sensible heat of ashes	Q_8
,, ,, ,, steam	Q_4	Thermal loss (radiation, &c.)	Q_9
Gross calorific value of gas	Q_5		

Then:

$$1.\quad Q_1 + Q_2 + Q_3 + Q_4 = Q_5 + Q_6 + Q_7 + Q_8 + Q_9$$

The hot efficiency of the system is

$$2.\quad 100\,(Q_5 + Q_6)/Q_1$$

The cold efficiency of the system is

$$3.\quad 100\,(Q_5 - q)/Q_1$$

q being the loss due to condensation of tar.

If all the quantities Q are measured, the equality represented by 1, above, will hold good within the limits of experimental exactitude; and if all factors but one are known, the value of the unknown factor can be determined by the aid of such a thermal balance-sheet, in accordance with the first law of thermodynamics, otherwise known as the law of conservation of energy.

However, as I have recently had reason to point out in connection with an analysis of the results of tests of water gas plant, a thermal balance-sheet may mislead, just as easily as a financial balance-sheet, if it does not reveal the facts. Thus, in the above case of the gas producer, the balance-sheet does not reveal the fact that it represents the additive effect of two processes which are interdependent. These may be described as the carbonization and the gasification processes.

In the gasification process, the reactant materials are hot coke (the product of the carbonization of the coal) steam, and air. The products are hot gas and ashes. Thus, writing:

Sensible heat of coke t_0 to t_C	Q'_1	Sensible heat of gas t_0 to t_K	Q'_5
,, ,, ,, steam at t_S	Q'_2	,, ,, ,, ashes t_0 to t_S	Q'_6
,, ,, ,, air t_0 to t_A	Q'_3	Thermal losses	Q'_7
Heat of reactions in fuel bed	Q'_4		

the thermal balance of the gasification process is:

$$Q'_1 + Q'_2 + Q'_3 + Q'_4 = Q'_5 + Q'_6 + Q'_7.$$

In the carbonization process the reactant materials are coal and hot gas. The products are cooled gas from the gasification process (possibly slightly modified by reactions taking place in the region of gasification), distillation gas, and hot coke. We have then:

Sensible heat of coal	Q'_8
,, ,, gas from coke t_0 to t_K	Q'_5
,, ,, coke t_0 to t_C	Q'_1
,, ,, gas from coke t_0 to t_{CK}	Q'_9
,, ,, distillation gas t_0 to t_{CK}	Q'_{10}

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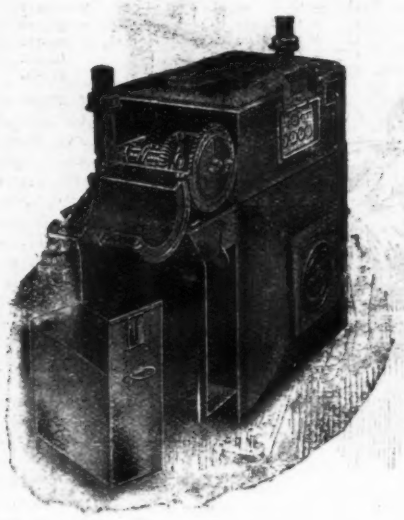

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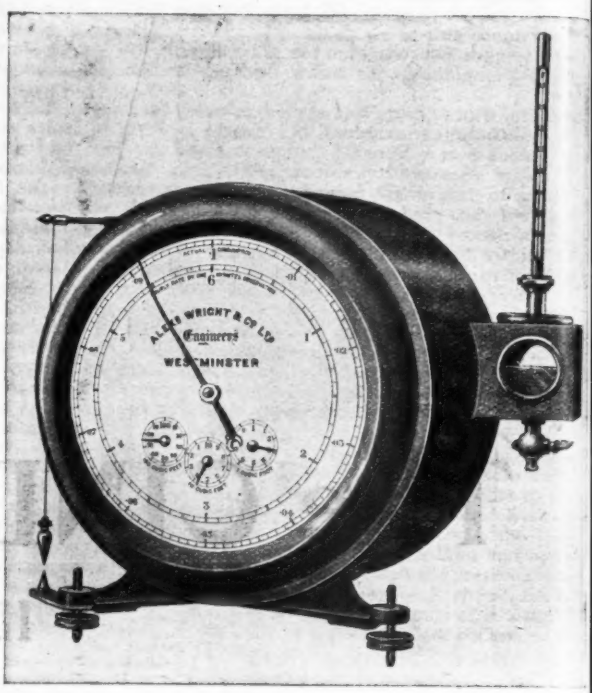

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The thermal balance of the carbonization process is:

$$Q'_8 + Q'_5 = Q'_1 + Q'_9 + Q'_{10}$$

Since Q_8 is very small, we may write:

$$Q'_5 - Q'_9 = Q'_1 + Q'_{10}$$

Now the quantity on the left hand is the heat lost by the gas generated by the action of air and steam on the coke when the gas is cooled from t°_g to t°_{cg}. The quantity on the right-hand side is the heat required to carbonize the coal when the process is effected at t_c, and the gas leaves the plant at t_{cg}. In actual practice the gas generated from the coke in a gas producer contains about 50 p.ct. of nitrogen; and it suffices for the moment to point out that one-half of the heat available for the carbonization of the coal is carried by this nitrogen. It follows that if the process is modified by replacing air by oxygen, or in any manner so that the nitrogen does not pass through the coal, the process itself must be profoundly modified so that the coal may be carbonized. The result can only be arrived at quantitatively by the thermal analysis of the process by the second method. Any conclusion arrived at on the basis of the first method may be entirely misleading.

By this method, which I have just outlined, it is usually possible to determine whether any particular process involving the gasification and carbonization of coal in two stages can or cannot be carried out. As a matter of fact, the method of investigation is rarely employed; but I venture to suggest that were it universally employed, only a very small proportion of processes for the carbonization and gasification of fuel which are patented annually would ever be put forward, and many supposed improvements which are doomed to failure would never be tried. However, it is possible that it may find wider application if the data used in the calculations are collected and put together; and it is with the object of doing this that I have written this paper.

For the purpose of illustrating the application of this method of investigation, I have taken as examples the low-temperature carbonization of coal by producer gas or by steam, and the complete gasification of coal to produce mixed water gas and coal gas. I have not dealt with the problems from the point of view of particular proprietory processes, or attempted to indicate how they have been or can be handled in actual practice.

An important convention used in compiling thermal balance-sheets is the datum temperature, which, in accordance with the Continental practice, I have taken as 0° C. In making all calculations I also adopt the convention, which at first sight involves an absurdity, that water vapour can be cooled to 0° C. without condensing. Actually this convention is adopted in calculating net calorific values. In practice it simplifies calculation by eliminating the heat of condensation from both sides of equations, involving quantities of water vapour which relate to temperatures at which water is not condensed.

Calculation is also much simplified by the use of molar units. The use of the Centigrade scale and the Centigrade heat unit (C.H.U.) makes it possible to apply the same numerical data as are in use with the pound-mole or kilo-mole. However, as a unit of volume the cubic foot at 60° Fahr. or 15·55° C., and at 30 in. mercury pressure, is so widely used that it is necessary to adopt it. To connect mass and volume, it is assumed that 1 kilo-mole of the permanent gases at normal pressure, or of the heavier gases in mixtures in which their partial pressures are small, occupies 22·9 cub.m. at 0° and normal pressure; and on this basis one pound-mole occupies:

357·8 c.ft. at 0° C. + 30 in. pressure, dry
369·6 ,, ,, 15·55° C. + 30 ,, ,, ,,
385·0 ,, ,, 15·55° C. + 30 ,, ,, saturated

(Note.—30 in. = 762 mm. Normal pressure in London is 750·5 mm.)

Data Used in Calculations.

It is unfortunate that there is no agreement as to the more important conventions employed in compiling thermal balance-sheets, nor certainty as to the values of very important constants. I venture to suggest that the matter should engage the attention of the Institute of Fuel, and that a Committee should be appointed to deal with the matter. Some very important data, such as the heats of combustion of hydrogen and carbon monoxide, rest on the results of inferior experimental work, and should be redetermined; and when dealing with carbon we have to face the fact that the heat of oxidation depends upon the form of carbon, whether graphitic or amorphous. For pure graphite the heat of formation in C.H.U. per lb.-mole is given by Roth

$$C + O_2 = CO_2 + 94{,}270,$$

that for wood charcoal by

$$C + O_2 = CO_2 + 97{,}000,$$

but for reasons given elsewhere ("J.S.C.I.," 1927, XLVI., 128Tt) I have adopted the value for carbon in coke:

$$C + O_2 = CO_2 + 94{,}750.$$

The most reliable value for the heat of combustion of carbon monoxide is that of J. Thomsen:

$$2CO + O_2 = 2CO_2 + 2 \times 67{,}875.$$

Combining these data with the data for the formation of water:

$$2H_2 + O_2 = 2H_2O \text{ (steam)} + 2 \times 57{,}785$$
$$H_2O \text{ (steam)} = H_2O \text{ (water)} + 10{,}725 - 10t^\circ,$$

we obtain value for the following heats of reaction at constant pressure:

$2C + O_2 = 2CO + 2 \times 26{,}875$
$C + H_2O = CO + H_2 - 30{,}910$
$C + 2H_2O = CO_2 + 2H_2 - 20{,}820$
$CO + H_2O = CO_2H_2 + 10{,}090$
$C + CO_2 = 2CO - 41{,}000$

The values commonly employed are, for some entirely unexplained reason, based upon the heat of combustion of charcoal, which bears no relation to coke as known in industry.

For calculations involving the sensible heat of gases I have adopted values of mean interval molar heats between 0° and t° C., arrived at by Partington and Shilling ("Specific Heats of Gases"), after reviewing the whole of the experimental data. In the following table the results are in C.H.U. per lb.-mole (K.C. for kilo-mole) between 0° and t° C. In technical calculations of the kind which we are considering, the values for C_2H_2, C_2H_4, H_2S, SO_2, &c., usually present in relatively small quantities in gaseous mixtures, may be taken to be the same as for CO_2.

Molar Thermal Capacities of Gases t° to 0° C. in C.H.U.

0° to t° C.	Air, O_2, N_2, CO.	H_2.	CO_2, &c.	H_2O.
15·5	110	..	..	..
100	695 C.H.U.	685 C.H.U.	895 C.H.U.	910 C.H.U.
200	1395	1380	1,830	1790
300	2100	2080	2,805	2650
400	2805	2785	3,840	3515
500	3515	3500	4,870	4385
600	4230	4225	5,955	5260
700	4945	4955	7,975	6155
800	5670	5690	8,225	7070
900	6400	6435	9,450	8010
1000	7135	7185	10,610	8980

For heavy hydrocarbon vapours I have shown elsewhere ("GAS JOURNAL," Sept. 3, 1924) that the thermal capacities of the vapours can be calculated approximately from the formula:

$$C = (5 + 0{\cdot}005t)t,$$

where C is the amount of heat lost by a quantity of hydrocarbon vapour containing 12 lbs. of carbon when cooled from t° to 0°, supposing that no condensation takes place in the process.

The material which condenses as tar leaves the plant partly as liquid, in drops as tar fog, and partly as vapour. One can only make a guess at the latent heat of vaporization. The data (molar) for known hydrocarbons per mole (12 lbs.) of carbon as hydrocarbon are as follows:

Hydrocarbon.	C_6H_{14}.	C_8H_{10}.	$C_{10}H_{22}$.	$C_{12}H_{26}$.
L	1000 ..	1150 ..	850 ..	700

The highest member of this series boils at about 200° C., which is about midway between the beginning and the end of the range of distillation. We shall not be very far wrong in adopting the value, L = 700 in molar units per 12 lbs. of carbon in the volatile part of the tar. The specific heat of the non-volatile part is an approximation,

$$C = (4{\cdot}2 + 0{\cdot}004t)t$$

per 12 lbs. of carbon.

The specific heats of the solid product is also a matter for approximation. Schläpfer and Debrunner (Helv. Acta Chim., VII., 31) have recently shown that well-burned coke has a specific heat which can be calculated very exactly from the specific heat of graphitic carbon and the specific heat of silica. The data for the thermal capacities of graphitic carbon (molar) and of silica (pounds) t° to 0° C. are given below:

Thermal Capacities t° to 0° C.

—	Graphitic Carbon (Molar).	Silica (Pound).
1°	1·82	0·189
100	226	20·0
200	530	42·5
300	895	66·5
400	1310	92·0
500	1765	118·5
600	2245	146·0
700	2745	173·5
800	3250	201·5
900	3760	228·5
1000	4280	256

Data relating to the amorphous forms of carbon at relatively low temperatures are so erratic that it is impossible to make use of them, but they are possibly vitiated by absorption effects. In the neighbourhood of 600° to 800° the specific heats of amorphous and graphitic carbon are not very dissimilar; and this is the range which is most important. When coke is only partially carbonized, it is necessary to take into consideration the fact that it contains hydrogen; and though the quantity

of hydrogen may be small, its specific heat (molar) is high. I have adopted the value for the molar heat $t°$ to 0° originally assigned to it by Kopp, 4·6 t, a quantity which approaches the value of the thermal capacity $t°$ to 0° C. at constant volume. We may adopt the same value for oxygen and nitrogen.

MANUFACTURE OF WATER GAS FROM COAL.

We can consider the process as taking place in two stages, similar in character to the two stages in the producer gas process. They are as below:

(*a*) The carbonization of the coal by the hot gas, and the formation of coke.

(*b*) The gasification of the coke by the alternate action of air and steam.

The word "alternate" differentiates the water gas from the producer gas process.

Now in the hot producer gas process the conditions in the upper part of the region where the fuel is completely coked approach those of equilibrium, which is not the case in the Mond process—or in the blow or run of the water gas process. Indeed, the efficiency of the water gas process depends upon operating in such a manner that equilibrium shall not be attained in the blow process, but that the CO_2 content of the blow gas shall remain as high as possible. Since the velocity of the reaction,

$$CO_2 + C = 2CO,$$

increases very rapidly with temperature and becomes almost instantaneous at about 1100°, the upper limit of temperature in the fuel bed of a water gas plant must probably lie between 1000° and 1100°.

On the other hand, the lower limit of temperature is fixed by the requirements of the steam-run process. It is not possible to discuss the mechanism of that process, but it suffices to point out that as the temperature of coke falls between 900° and 800°, the CO_2 content of the gas produced by the action of steam upon it increases to beyond the limit allowable in water gas practice. The process is probably most efficiently operated between limits of temperature slightly over 1000° and slightly below 900° C. We must consider, therefore, that the coke is delivered to the gasification zone in the plant at a temperature about 850°, and we will use this figure for a basis for calculation. The action of steam on coke below this temperature may be considered negligible.

As a basis for calculation we can assume that if a coal of the following composition—C 78, H 5, N 1·5, S2, O 6, ash 7·5 p.ct., and water equal to 5 p.ct. in the coal—is carbonized by actual contact with hot gas so as to produce coke at 850° C. and volatile products at 350°, about 10 p.ct. of the carbon will appear as tar, and about 13,500 c.ft. of gas, 14 cwt. of coke, and 16·5 gallons of liquor will be produced. The distribution of the constituents of the coal may be considered as distributed approximately as below in terms of lb.-moles per ton of dry coal.

—	Coal.	Gas.	Tar.	Liquor.	Coke.
C	145·60	17·80	14·55	..	112·25
H_2	56·00	41·65	4·7	2·6	7·65
N_2	1·20	0·5	..	..	0·50
S	1·40	..	..	..	0·70
O_2	4·20	2·90	..	1·3	..
Ash	(168 lbs.)	..	..	..	(168 lbs.)
Moisture	(680)	1·45	..	5·35	..

The composition of the coke is supposed to be: C 87·0, H_2 0·95, N_2 0·85, S 1·45, and ash 9·75 p.ct.; and that of the gas:

CO_2.	CO.	C_2H_6.	CH_4.	H_2.	N_2.	Moisture.
3·15	10·3	3·55	26·7	54·9	1·45 dry p.ct.	..
1·10	3·60	1·25	9·35	19·20	0·05 lb.-moles per	1·45 ton of coal

The amount of heat required to carbonize the coal under the conditions laid down is calculated as follows:

Sensible heat of coke at 850° C.—		
Carbon	112·25 × 3500 =	392,900
Hydrogen, &c.	8·85 × 4·6 × 850 =	34,600
Ash	168 × 242 =	40,200
		467,700
Sensible and latent heat of steam at 250° C.—		
9·4 (3080 + 10,725)		131,800
Sensible and latent heat of tar at 350° C.—		
14·55 (700 + (4·2 + 0·0004 × 350) 350)		38,400
Sensible heat of gas at 350° C.—		
CO_2, C_2H_6, CH_4	11·7 × 3310 =	38,700
CO_1, H_2, N_2	13·0 × 2450 =	76,000
		114,700
Total.		752,600

In the water gas process operated with coal as fuel, both the water gas and the blow gas pass through the region of the fuel bed in which the process of carbonization is taking place. The process of carbonization is then effected largely by the blow gas, so that a large part of the distillation gas is lost. In certain modifications of the water gas process, however, only the water gas passes through the region of carbonization. Supposing that this gas enters the region of carbonization at 900° C. and leaves it with the volatile products at 350° C., we can calculate the quantity of water gas which must be passed through the coal to carbonize it from the following data:

In an analysis of the water gas process published in the "Journal of the Society of Chemical Industry" (December, 1924), it is shown that in normal British practice the composition and content of 1000 c.ft. of water gas, measured at 15·5° C. saturated, and 30 in. pressure, is approximately as below:

—	Composition Dry.	Composition at Top of Fuel Bed.
	P.Ct.	Lb.-Moles.
CO_2	5·5	0·1428
CO	39·0	1·0124
H_2	49·0	1·2704
CH_4	0·5	0·0130
N_2	6·0	0·1558
H_2O	..	0·2290

The following data are also available from the same paper:

Sensible heat of 1000 c.ft. water gas (15·5°)	900° ..	18,900
	350° ..	7,000
		11,900

Quantity of water gas required to carbonize one ton of coal, 753,100/11,900 = 63,500 c.ft.

Now, as only 14 cwt. of coke is available from a ton of coal, it would be possible to carbonize the coal effectively only if the water gas were produced at a rate equivalent to 91,000 c.ft. per ton of coke. In the paper referred to it is shown that the make of water gas per ton of coke is dependent mainly on the efficiency of the blow process. It is influenced to a very small extent by the fact that in the combined carbonization and gasification process the coke is delivered to the gasification zone hot. The output could be increased by about 10 p.ct. by delivering the steam to the fuel bed superheated to 800° C., or, roughly, in less proportion at lower temperature. In practice, superheating the steam, except in so far as it dries the latter, is not a very efficient means of increasing output, and it has no influence on the temperature at which the gas leaves the fuel bed.

An output of 70,000 c.ft. per ton of coke probably represents the limit attainable in blue water gas practice, and then only when 6 to 7 p.ct. of CO_2 is permitted. 55,000 c.ft. is probably a very good average for carburetted water gas practice. It follows, therefore, that the quantity of water gas which can be produced in a process for the complete gasification of coal is in any circumstances insufficient to effect the carbonization of coal, and, making allowance for losses, and for the fact that a certain proportion of the water gas would be produced by down-running, and would not pass through the coal at all, probably insufficient to the extent of about one-half.

Discussion.

The CHAIRMAN said it was necessary to have some proper basis of comparison, and he considered that the Institute of Fuel was the right body to take such a thing in hand.

Dr. R. LESSING suggested that it might be advisable for the meeting to agree to a recommendation to the Council of the Institute to consider the setting up of a Committee to deal with the matter.

Mr. EDGAR C. EVANS (Joint Hon. Secretary) said he felt fairly certain that the Council would be delighted to consider such a recommendation. The points raised by Dr. Travers were of the greatest possible importance. As was pointed out in the paper, if a number of the processes that had been adopted for the low-temperature carbonization of coal had been studied from this standpoint they would not have been patented, or, if they had been patented at the outset, they would have been carried no further. He wondered what practical method could be evolved for investigating the question. There was no doubt that research was necessary with regard to some of the points which Dr. Travers had raised in his paper.

Dr. T. BARRATT (Member of Council) seconded Dr. Lessing's proposition.

Mr. A. WORSLEY pointed out that the question of finance would arise, and suggested that the meeting might be treading upon the toes of the Council if it passed a resolution asking the Council to incur certain expenses. It might be that the Council had other work in view; and, in consequence, it might be rather awkward if the proposition now under discussion were put before the Council.

The CHAIRMAN said he did not think Dr. Lessing had meant anything so sweeping as to tell the Council what it ought to do. He was merely supporting the views put forward by Dr. Travers.

Dr. LESSING agreed that this was so.

Dr. TRAVERS remarked that his view was not that the Institute should undertake anything in the way of research, but that a Committee should look into the question of a datum point, and questions of that kind. It was a matter of considering what data were available, whether they were reliable, and whether research was required. The expenses incurred would be the expense of correspondence and of meeting, which he imagined the members of the Com-

mittee would bear themselves. He believed that ultimately the Committee would find information which would be useful, and which would eliminate largely the necessity for further research.

Dr. LESSING said that if the proposition were put forward in the form of a recommendation to the Council, as he had suggested, it would not necessarily involve expense. So far as the meeting knew, the Council might not entertain the suggestion.

The proposal was put to the meeting, and carried.

VOTE OF THANKS TO THE CHAIRMAN.

Dr. TRAVERS proposed a hearty vote of thanks to Mr. Terrace for having presided.

The CHAIRMAN, responding, said that it was a great pleasure to him to preside at the meeting, particularly as it served to demonstrate the very close connection between the Institute of Fuel and the Institution of Gas Engineers.

UNPAID-FOR GAS AND COKE.—WHERE DO THEY SHOW IN THE ANNUAL ACCOUNTS?

By NORTON H. HUMPHRYS.

As regards about 99 out of every 100, the answer is "Nowhere." The unpaid-for gas, so far as the accounts are concerned, costs nothing, and the same may be said of the coke and breeze used in the retort house, boiler house, and for other purposes on the works or district. To such extent the accounts as published are incomplete and incorrect.

Accountants are acquainted (sometimes too intimately) with "compensating errors," equal on each side of the accounts and therefore not affecting the accuracy of the balance, which may be correct though the totals are wrong. If £100 is omitted on the credit side, and a similar item (not necessarily connected therewith) is also omitted on the debit side of the revenue account, the balance carried to profit and loss may be right, but the totals will be that much short. This happens with regard to the omissions above noticed; and the correct cost of gas in the wide sense of including manufacture, purifying, storing, distribution, and establishment expenses is not shown. One consequence is that neither of these items receives the amount of attention that it deserves, and sometimes entirely escapes notice.

The distinction between "unpaid-for" and "unaccounted-for" gas should be clearly understood, as sometimes they are regarded as synonymous terms. The former includes free gas supplied to works, offices, showrooms, official residences, &c., intentionally not charged for, such as a few high-power lights at important crossings, or for advertising purposes, in addition to the *bona fide* "unaccounted-for." The presumption is that all gas thus supplied will be either metered or estimated as closely as circumstances permit. Under municipal ownership the free list may include other departments, perhaps a few charitable institutions, and even the entire street lighting. In earlier times the quantity of gas used but not paid for was not an important item, and rarely exceeded 2 p.ct. of the total quantity made, under joint stock ownership, and no gas engines were used on the works. Hence the origin of a custom that now calls for revision, because the use of gas for advertising purposes, as in a set of showrooms, where every possible use for gas is daily practically demonstrated, has now substantially increased.

As an illustration, a copy of the audited revenue account issued by a small gas undertaking is shown in the table attached, under Column A. The quantities of gas concerned are as follows:

Make,	25,200,000 c.ft.;	average B.Th.U., 515;	129,780 therms.
Paid for,	22,529,000 ,,		112,645 ,,
Unpaid for,	2,671,000 ,,		17,135 ,,
Equal to	10·6 p.ct.		13·2 p.ct.

A searching examination which should include the following items is necessary before accepting an account in this form as a correct presentation of the actual cost of gas.

A revised form is shown under B, the corrections including the unpaid-for gas and coke, which are valued at bare cost and not at selling price, also having regard to the following:

Revenue Account, 1926.

—	A.	B.	C.
	£ s. d.	£	£
Gas sales	6743 19 5	6,744	..
,, chargeable to selves	..	540	6966
Rents, meters, and appliances	457 9 10	457	..
Residual products	1748 14 1	1,749	..
Coke to selves	..	750	..
Profit on fittings	42 19 8	..	..
Transfer fees	1 5 0	..	..
	£8994 8 0	£10,240	£6966
Manufacture—Coal	4544 9 8	4,544	2795
Coke	..	750	..
Wages	950 8 3	950	950
Repairs and depreciation	1401 4 10	1,401	944
Public lamps	123 9 8	123	..
Rates, taxes, insurance	424 15 7	249	249
Salaries and fees	571 10 0	572	572
Incidental	84 0 4	84	84
Gas unpaid	..	540	540
Discounts and allowances	194 11 6	195	..
	£8294 9 10	£9,408	£6134
Balance to profit and loss	699 18 2	832	832
	£8994 8 0	£10,240	£6966

REPAIRS.

In this instance "repairs" happens to be satisfactory, being about 20 p.ct. of the receipts for gas, which is a reasonable proportion if no other provision for depreciation is made. The amount of this item should have special attention in view of the common tendency to stint it in bad years and unduly to inflate it in good ones. Apart from any special or extraordinary circumstances, the repairs and renewals (in small works at any rate) cannot be evenly distributed one year against another; and for close comparisons or valuations a preferable plan is to take an average over a term of years, rather than of any one single year. And if a special sum is also written-off as depreciation (sometimes erroneously shown in the profit and loss account), it should be included in revenue, as may conveniently be done under "repairs." In fact, that item may well be regarded as including repairs, renewals, and depreciation.

INCOME-TAX.

The method of disposal of income-tax in the accounts is important in these days of 4s. in the £ nominal, but practically 5s. or more. It is not a proper charge on revenue, and therefore has been transferred to profit and loss as a charge on profits, and not on working expenses. The effect of regarding it as a revenue item may be seen by comparing A and B.

Turning to the credit side, the item of gas sold through prepayment meters should not pass unnoticed, because sometimes it includes the total receipts. In the account A, the amount taken from the cash tills has been fairly allocated as between gas and rents—the former charged at current ordinary price and the balance charged to rents of meters and appliances. An addition of £540 has been made as representing "unpaid-for" gas, shown on the other side as "gas sold to selves." The coke and breeze used on works is treated in similar manner.

FEES.

The remuneration of directors and auditor is sometimes found in the profit and loss account instead of the revenue account, to which it properly belongs. It is so dealt with in the specimen account.

GENERAL.

In passing, we may remark that the company not only pay the bare amounts deducted from the dividend warrants, but also the tax on it. The shareholder is also charged on his total income, or, if able to claim a refund, the super-tax is not included. The "tax on the tax" is therefore paid twice.

Profits on sale of fittings, transfer fees, and other incidental items are not earned by sales of gas, and are therefore omitted.

The correct cost of gas can be computed from the revised account B in the usual way.

The gas unpaid-for is more when stated in terms of therms than in cubic feet, being increased by the difference between the actual and the declared value. Consequently, while the loss as expressed in cubic feet is 10·6 p.ct., the therms show 13·2 p.ct. Small undertakings working under the 1920 Act must necessarily keep the quality some 3 or 4 p.ct. in excess, in order to be on the safe side. The bare obligation is to supply 126,000 therms; but as the average quality is 515, the actual output was 129,780. To the loss in cubic feet must be added the difference or loss of 3780 therms, which accounts for the difference in percentage. A similar and probably greater difference was experienced under the candle standard of quality, though it did not figure in the accounts; and an undertaking about to adopt the 1920 Act must not conclude that one result will be an additional item in the unpaid-for gas account.

Following the form of account adopted by the Board of Trade in connection with applications under the 1920 Act, B has again been revised as shown in C, simply by transference of receipts for rent of meters and appliances to repairs, and those for residuals to coal. But these items should be retained on the statement, not eliminated as compensating errors.

So far as the statements of accounts as issued to the shareholder are concerned, the compensating errors above-mentioned are of no consequence, and there are inconveniences about alterations in the form of published accounts, which explain why the 1920 form has not been generally substituted for that based on the Gas-Works Clauses Act, 1871. Considering that more than 95 p.ct. of the statements issued to shareholders go straight to the waste-paper basket, summarizing to a still

greater extent might be favoured; but a full and complete statement should be available for the use of engineers and directors who require accurate information as to cost of gas.

The position of profit from sale of fittings in the accounts is generally not correctly understood. As with free gas, in former times it was not an important item, but is now of more consequence. It has been regarded as an addition by both shareholders and consumers. The former have stood up for a full trade profit, in contra-distinction to more favourable and presumably more attractive terms; and gas undertakings have been twitted as avaricious and grasping, not contented with legitimate profit but seeking to increase it by perquisites, or to utilize a strong position in competition with less fortunate traders.

Assumption in this direction is absolutely wrong when applied to undertakings limited by Act of Parliament to a maximum dividend. In the example above-named, the shareholders had been accustomed to receive the maximum rate of dividend for many years before the sale of fittings was taken up, and they cannot get any more now, though the profit on fittings is equal to ½ p.ct., and many undertakings are making 1 to 2 p.ct. Formerly the entire 10 p.ct. came from the sale of gas, but now the fittings provide ½ p.ct., leaving gas chargeable with not more than 9½ p.ct. Practically the profits from fittings go direct to the consumers in the form of a lower price for gas; and as much may be said if the undertaking is subject to a sliding-scale, with the very slight exception that the shareholders may obtain a trifling proportion in the form of an increased rate of dividend following a lower price for gas.

It is absurd to contend that the gas undertakings are out for nothing better than an addition to profit; and if there were no other advantages, many would decline the sale of fittings. The indirect benefits, which are the chief consideration, are so well known that they need not be recapitulated here. The consumers should clearly understand that the business practically belongs to them, that the undertaking conducts it on their behalf, and that a large consumer may eventually recover the profit on his expenditure in the gas company's showroom, by the medium of his gas bill. Yet sometimes large consumers will oppose the gas-works fittings department, in ignorance of the fact that they are thus resisting a reduction in the price of gas.

SILICA AND FIRECLAY REFRACTORIES.

By A. T. GREEN, F.Inst.P., Assoc.M.Inst.Chem.E.

[From a Paper before the Institution of Chemical Engineers on Dec. 9 last—Mr. H. J. POOLEY, C.B.E., presiding.]

Speaking of the texture of fireclay products, the author said that the refractoriness of a coarse-grained product is greater than that of a fine-grained one, other factors being equal. Further, the tendency of the coarse-grained brick to crack and split with abrupt changes of temperature is much less than that of a fine-grained product. The crushing strength and tenacity of a coarse-grained brick are, however, always low. Thus, gas-retort sections, with a feeble tensile strength, are very friable and readily disintegrated by shocks, abrasion, and such actions. The pores of the coarser products are generally large, with the result that flue dust and slag penetration rapidly takes place in practice. Thus it appears clear that with such antithetical properties for these two types of material it is often desirable to compromise.

In general, it is found that a "fine" texture is more effective in the carbonizing industries, whereas the coarser material finds greater favour in the steel industry. The mechanical strength of the material depends on the nature of the coarser fragments—*i.e.*, their angularity, the amount of the fine fraction, and the firing treatment. Fragments of high angularity with about 40 p.ct. of "fines" and an adequate firing in the neighbourhood of Cone 16 produce a strong brick. The "flour" of silica—*i.e.*, the fine fraction—is of first-rate importance, since it determines the matrix formation and the alteration of the silica, both of which phenomena take place during the high-temperature period of the firing.

The hardest firing is not always the correct one for the production of a material for a specific duty. In fact, for steel furnace roofs, bricks which have received medium firing treatment appear to be the more desirable. For coke ovens and gas retorts those silica bricks which have received excessive firing are certainly the most successful.

The refractoriness of a good fireclay or its product, under normal conditions of test, varies from Cone 20 to Cone 35 (1530° to 1770° C.), while that of a silica product varies from Cone 32 to Cone 34 (1710° to 1750° C.), and a siliceous product about Cone 30 to Cone 32 (1670° to 1710°). Such data form a preliminary guide to the heat-resisting properties of refractories.

REFRACTORINESS UNDER LOAD.

The study of refractoriness under load has proceeded for the past twenty years, but the early work of Mellor laid the basis of the present accepted test. Dale has developed this test to a high degree of proficiency, recently obtaining data of fundamental significance.

If the Gas Engineers' classification of silica and fireclay materials be accepted (silica products greater than 92 p.ct. SiO_2, fireclay less than 82 p.ct., and siliceous 82 to 92 p.ct. SiO_2), it is found that silica, siliceous, and fireclay products have approximate refractoriness values of 1720°, 1680°, and 1650° C. respectively as indicated by the cone-temperature method. Under a load of 50 lbs. per sq. in., however, the temperatures of collapse of these three products are approximately 1670°, 1480°, and 1350° C. respectively. Variations from these figures depend on a number of factors, including (1) the composition of the refractory material—*i.e.*, the amount of fluxes and iron oxide—(2) the firing treatment, (3) the physical nature—*i.e.*, the texture. The rigidity of the silica brick is maintained up to the point of collapse, which is approximately 300° higher than the "safe" value for an average fireclay product.

In general, silica bricks show a mechanical fracture in contrast with a squatting or viscous deformation which is the usual mode of failure of fireclay products.

The influence of grog should also be considered. There appears to be a limit to the amount of grog which can be incorporated in a fireclay brick; and information regarding the limit can be deduced from the modified under-load test. When non-porous or excessively vitrified grog is used, failure is mostly by rupture. With a moderately porous grog, a pre-soaking of the grog particles in water leads to increased resistance to deformation at temperatures below that of rapid collapse. With 40 p.ct. or more of vitrified grog, large particle size tends to cause premature failure under stress at high temperatures, chiefly by rupture round the large grog particles.

AFTER-CONTRACTION AND AFTER-EXPANSION.

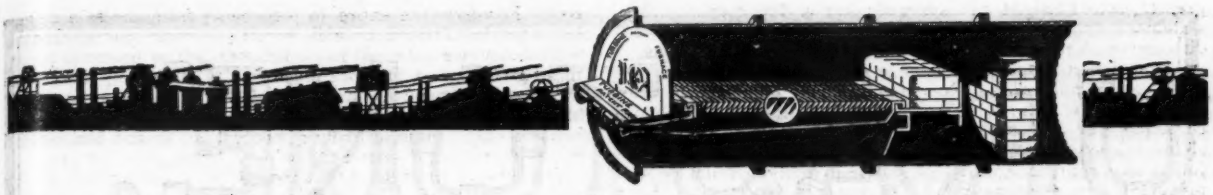
The changes which occur during the firing of refractory materials belong to a class known as arrested reaction. In these the chemical and physical changes are arrested at particular and definite stages before they are completed. When firebricks are burned or fired in the kiln, the fluxes melt and dissolve the less fusible materials, binding the whole more or less firmly together. A certain amount of contraction occurs during the operation, and if not completed during the firing of the brick it will subsequently continue when the brick is in use. This is called the after-contraction. If this after-contraction is considerable, the masonry of the furnace will most certainly be displaced when the bricks are in use. The after-contraction must be small—certainly under 1 p.ct.

Straight silica products usually show an after-expansion consequent on the more or less gradual change of quartzitic silica with a specific gravity of 2·65 to one or both of two other varieties with specific gravities 2·28 and 2·32. The complete change involves 16 p.ct. expansion, but it is a slow reaction and usually progresses a little each time the brick is fired. It can be seen, therefore, that the original firing of silica bricks should result in such a reduction in specific gravity as is compatible with the subsequent use of the product. For coke oven and gas retort work, where an after-expansion would set up very bad strains in the structure, the after-expansion effect must be as low as possible, and thus the specific gravity of such material must be low; for, as Rees has shown, with most silica bricks except the very coarse-grained products there is a linear relationship between specific gravity and after-expansion as obtained by test.

In the case of semi-silica or high siliceous products, the tendency is to obtain a product which does not show either after expansion or contraction. This may or may not be obtained where silica rock is added to a fireclay as a reinforcement; much depending on the grain size of the addition.

SPALLING.

The resistance to spalling of refractories plays a great part in their successful durability in industry. Spalling can be regarded as the failure of a refractory to withstand without disruption those stresses induced by temperature fluctuations or thermal shock under the general and special conditions of industrial usage. At least three factors are involved. These are (1) the rate of change of temperature which can be effected under definite conditions in the interior of a refractory mass; (2) the elastic and viscous properties of the material; (3) the nature and extent of the volume changes set-up by rapid fluctuations of temperature. The first factor is defined by the coefficient of temperature diffusivity of the material, together with measurements respecting the size and contour of the mass. The second is exceedingly difficult of definition, while the third



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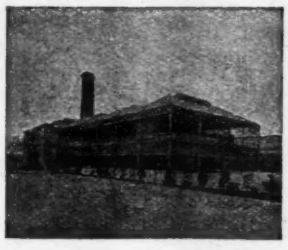

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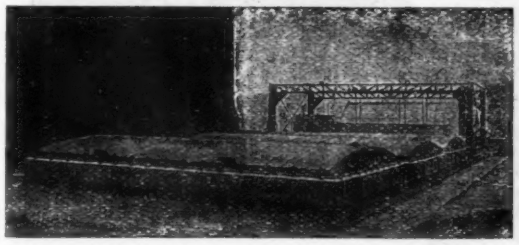

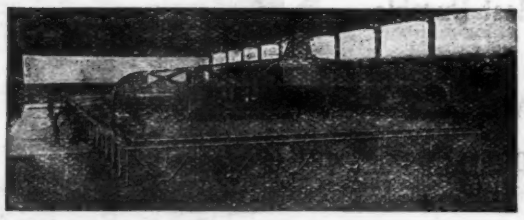

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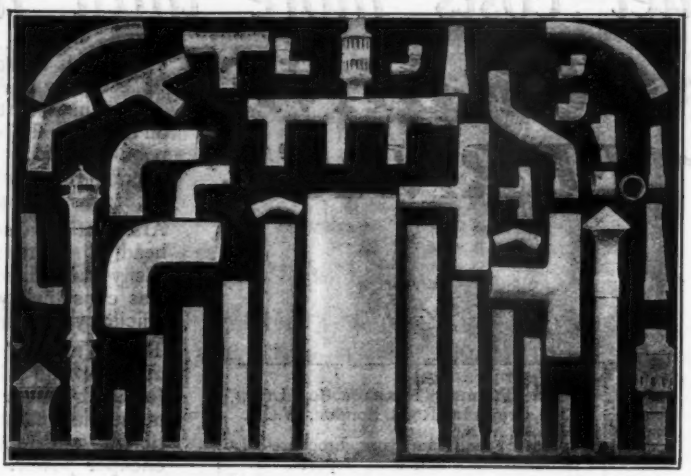

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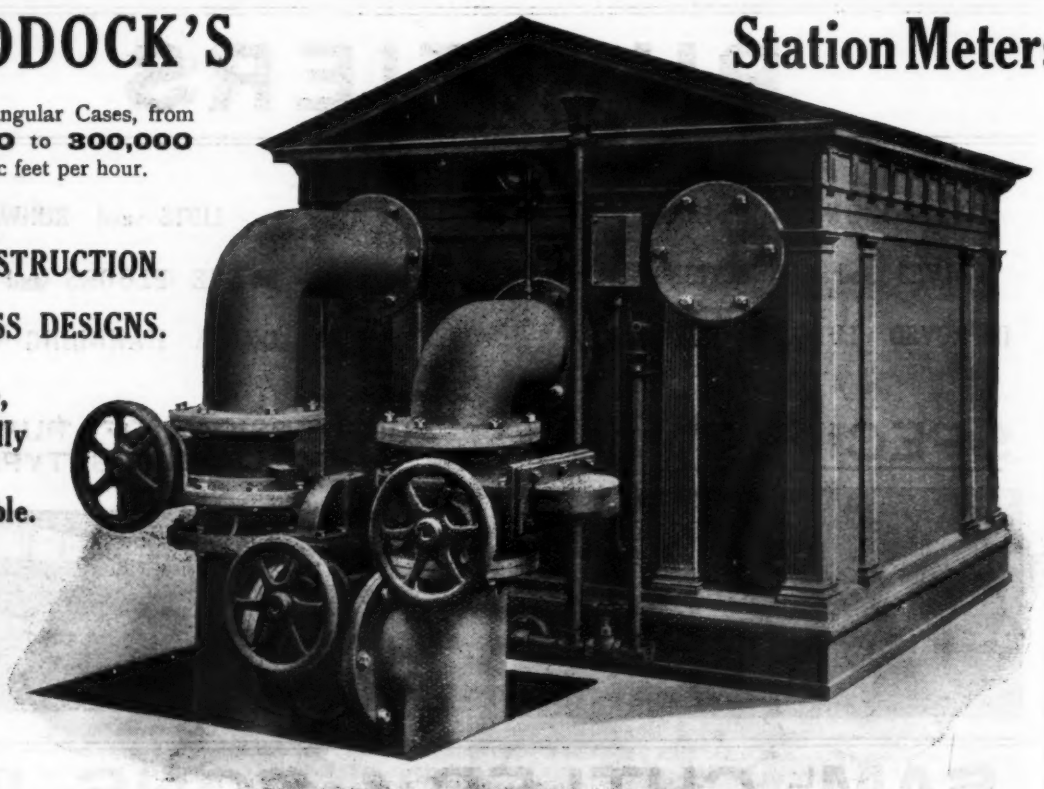

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can be adequately circumscribed by a study of the thermal expansion and the velocity of these changes involving expansions observed in the constituents of the refractory product.

Norton has recently evolved a formula based on considerations of homogeneity, circumscribing the spalling tendency of refractories, and similar to the well-known formula of Winklemann and Schott for the endurance of glass. This is written

$$S = \frac{E}{F \cdot K^{\frac{1}{2}}}$$

where S = spalling tendency, E = coefficient of thermal expansion, F = the maximum shearing strain, K = the coefficient of temperature diffusivity. The maximum shearing strain, or "ultimate strength" factor is not in itself truly elementary, but is rather a function of elasticity, viscosity, and a heterogeneity factor; the last-mentioned including the extent and nature of vitrification and porosity.

Silica products are particularly prone to spalling at both low and high temperatures.

Temperature Diffusivity and Thermal Conductivity of Fireclay and Silica Products.

The temperature diffusivity may be broadly considered as that property which controls the velocity or propagation of temperature in a mass of refractory material. The coefficient of temperature diffusivity may be said to express in C.G.S. units the rise in temperature produced in one cubic centimetre of substance by one calorie in one second, through one square centimetre of a layer one centimetre thick, having a temperature difference of one degree Centigrade between its faces. This conception has a particular value in those systems in which temperature is of more significance than total heat—*i.e.*, in the coke oven and the gas retort. In fact, in considerations of the carbonizing face temperature, temperature diffusivity measurements are of great importance.

The reported values of the coefficients of temperature diffusivity and thermal conductivity seem to depend on the nature of the adopted methods. Consequently there is a wide variation in the data available. The methods of measuring the thermal conductivity of refractory materials, which are based on Fourier's equation for linear diffusion, essentially determine the coefficient of temperature diffusivity. Using such a procedure, Heyn gives 0·0032 at 1000° C., Green 0·0040 at 1000°, and Tadokoro 0·0142 at 900° C. for the temperature diffusivity of a silica brick. In those methods of determining the coefficient of thermal conductivity which are essentially calorimetric, the temperature diffusivity can be computed from the observed values for thermal conductivity. This computation follows the equation

$$K = kcs$$

where K = coefficient of thermal conductivity, k = the coefficient of temperature diffusivity, cs = the heat capacity per unit volume. From the work of Dougall, Hodsman, and Cobb, the values for the temperature diffusivity of a firebrick at 500° is 0·0055, at 1000° 0·0068, and for a silica brick at 500° 0·0053, at 1000° 0·0088.

In considering the factors influencing temperature diffusivity the following points are of interest:

(1) The temperature diffusivities of fireclay and silica products increase with temperature.

(2) Increased firing treatment increases the value of this coefficient for both silica and fireclay bricks. This fact is particularly marked in the case of silica materials.

(3) A high porosity is not inimical to low diffusivity. Measurements indicate that at low temperatures with increasing porosity decreasing temperature diffusivity is to be expected, while at high temperatures the reverse phenomenon often holds good. In general, it appears that the rate of increase of temperature diffusivity with temperature at high temperatures is greater in the case of materials of high porosity.

Many determinations of the thermal conductivity of silica and fireclay refractories, based either on the usual formula or on mathematical analysis, have been reported. There is, however, little concordance between the results of the various investigations.

The following notes form a consideration of the factors influencing the thermal conductivity of silica and fireclay products:

(1) The value of this constant for a specific product increases with temperature.

(2) In recent years, there has been considerable discussion concerning the relative merits of silica and fireclay refractories as conductors of heat. This discussion, which has arisen from the increasing use of silica in coke oven and gas retort constructions, has been based on assumed practical experience, without reference to the actual determination of the coefficients of thermal conductivity of these materials. The opinion has been consistently expressed that silica brick is a better conductor than firebrick. From the early investigations of the present author, this statement did not seem to be true. In fact, so much variation between individual products was found that it appeared definitely incorrect to assert that one material was better than any other without the evidence of a test. The present position seems to be that, comparing superior products of each kind, there is little to choose between the two types at low temperatures (900° or so). However, since the rate of increase of conductivity with temperature is greater in the case of silica brick, the conductivity of this product at high temperatures is, in general, greater than that of fireclay goods. However, the temperature diffusivity of a well-burned silica product is on an average definitely greater than that of a fireclay product, particularly at higher temperatures, a fact which appears to account for the reputed effective thermal properties of silica refractories in the carbonizing industries.

(3) From Wologdine's and the author's work, it appears that increasing the firing heat treatment within the limits of the production of a commercial product increases the conductivity of both silica bricks and firebricks.

(4) The influence of porosity on the thermal conductivity of a refractory material has received considerable attention. It has been suggested that there is a relationship between thermal conductivity and porosity. While such a statement cannot be refuted (for, in part, it must be true) its limitations should be frankly recognized. In so far as the pore-spaces act as insulators, thus impeding the passage of heat, they have an influence on thermal conductivity. The term percentage porosity is used to indicate a measure of the pore-spaces, which naturally vary in size from easily-perceptible fissures to microscopic holes, many sealed off from the mass. The property of "pore-space" insulation depends on many factors, including temperature and the disposition, size, and shape of the pore-spaces. Now, since the measurement of percentage porosity does not include knowledge of these factors, a quantitative relationship between porosity and thermal conductivity cannot be anticipated.

It has been stated that the transference of heat through the pores is very small compared with that transmitted through the solid matter, or in other words, pore-spaces consistently maintain insulating properties. It would thus follow that the higher the porosity of a refractory material, the greater ought its insulating effect to be. This argument appears to be justified by the fact that such highly porous materials as diatomaceous earth bricks possess pronounced insulating properties at lower temperatures (*i.e.*, up to, at least, 700° C), and this under the accepted conditions of use. However, some investigators, notably Mellor, have as the result of practical observations and theoretical deductions suggested the hypothesis that, at high temperatures, heat may be transmitted by way of the pores, at a rate which is comparable with that of conduction through the solid matter.

The author's investigations give definite evidence that in the neighbourhood of 1100° the rate of increase in thermal conductivity with temperature in the case of certain materials possessing higher permeability to gases was greater than that obtained with the less permeable materials. This evidence proves that at high temperature the transmission of heat, by way of the pore-spaces, by convection and radiation is comparable with that by conduction through the solid matter, and that transmission by convection appears to take place to a much greater extent in the more permeable bricks.

Insulation.

By the use of carefully-selected insulating products it is possible to save anything up to 60 p.ct. of the heat otherwise lost by way of the structure. The insulation may have some definite effect on the structural stability of the refractory. In the normal passage of heat through the uninsulated wall the temperature gradient is steep, and, as a consequence, only a small thickness (an inch or so) is at a temperature of over 1000°. Therefore, in this instance, the combined action of temperature and pressure may not be of much moment. In the case of an insulated wall, probably 13½ inches or so are over this temperature. The safe range for certain fireclay products is not so high as was previously imagined, and a subsidence or viscous deformation can take place at temperature over (say) 1100°. Such considerations make it necessary to use the highest grade of refractories for the insulated furnace walls; otherwise failures due to incipient vitrification and consequent lack of stability of the firebrick may take place.

In many intermittent and other systems of heating, uninsulated refractories are subjected to decided fluctuations of temperature. With an insulated wall these fluctuations are rendered much less pronounced, and spalling troubles due essentially to thermal effects are reduced to some extent. However, the brittleness caused by crystallization is probably the cause of some spalling, which has been noted in certain insulated systems.

The author concludes his paper by consideration of the

corrosion, erosion, and physico-chemical disintegration of silica and fireclay.

Discussion.

Mr. H. R. TROST said that in the Institution of Gas Engineers' specification issued some years ago, before very much was known on this subject, the standard of load was arbitrarily chosen at 50 lbs. The whole object of the test of refractoriness under load was to get a test which approximated to practical conditions in the hot parts of high-temperature furnaces. In the case of coke ovens and similar furnaces, he did not think that a load of 50 lbs. was obtained in the hot parts—which were the portions that mattered so far as these tests were concerned. From inquiries he had made among oven builders and designers of fairly wide experience, they seemed to attempt to design generally for a load in the hot parts and exceeding 17 to 20 lbs. per sq. in. In his testing machine, it was possible to vary the load to conform with any specification, and he thought that the Institution of Gas Engineers' specification was wide of the mark so far as working conditions were concerned. A pressure of 20 lbs. would probably be nearer. On the Continent, the standard was about 15 lbs.

Mr. A. V. HUSSEY remarked that the author had stated that the crushing strength of coarse-grained bricks was always low; but surely this had something to do with manufacture. Was it not possible to grade the grog to get the required strength even with a coarse-grained brick? So far as silica firebrick was concerned, the only outstanding properties mentioned by the author were conductivity and resistance to alkalis. In some circumstances, silica bricks behaved abominably. He did not agree with the author's comparison of results obtained with fireclay bricks and silica bricks. The figures suggested that the advantage was with fireclays generally, and not with the best of fireclays. It was possible to get fireclay bricks—and he was actually using them—containing over 40 p.ct. of alumina which would stand up to a temperature of 1560° C. The results were largely due to improved methods of manufacture.

Mr. E. M. MYERS observed that whereas a particular brick in the laboratory would give a certain load test, another brick might give a lower figure, though both bricks had been made at the same time of the same materials and under the same conditions. Yet when the two bricks were used under industrial conditions, the one which gave the lower test in the laboratory might last longer. All this demonstrated how intricate was the technology of refractory materials. For years in America, and in the post-war period on the Continent, silica bricks had been adopted in the carbonizing industries. From the economic point of view, silica had come to stay. Secondly, from the point of view of capacity, silica bricks enabled much larger throughputs to be obtained in the carbonizing industry than would have been the case with quartzite material.

Mr. GREEN, replying to the discussion, agreed with Mr. Trost on the question of the specifications, and was of opinion that they had not yet reached a stage in their knowledge of refractory materials when specifications could be of the utmost value to the industry. As far as the influence of ash was concerned, he believed that the atmosphere of industrial operations had a great deal more to do with this than anything in the ash itself. This point could not be emphasized too strongly, because of the different ways in which similar bricks behaved under different conditions. Some recent work had shown this to be the case. It was true that the crushing strength with coarse bricks could be improved by careful grading of the grog; but at the same time there were always differences in crushing strength as between large grog and small grog. The difference between the under-load tests on similar bricks, referred to by Mr. Myers, was a fact; and he looked upon it as fundamental. So far as silica bricks were concerned, he looked upon the expression as a term representing a class of material. He did not suggest that silica bricks were bad; nor could he say they were good. To a large extent it was compromise, as in most things.

SUBMERGED FLAME COMBUSTION.

By NORMAN SWINDIN, M.I.Chem.E., A.M I.Mech.E.

[From a Paper before the Institution of Chemical Engineers on Dec. 7 last—Mr. J. ARTHUR REAVELL (Vice-President) presiding.]

An objection to the use of the submerged flame burner for many operations, and especially in connection with power production, is sulphur in the fuel, which burns to sulphuric or sulphurous acids which corrode the metal parts with which they come in contact. To protect the metal parts, a neutralizing agent in the form of soda or lime solution has to be pumped continuously into the generator; but the only real remedy is to use, when possible, a fuel comparatively free from sulphur.

Perhaps the most important element in a well-designed burner is the high-velocity tube, for on it depends the impossibility of back-fire. Many early inventors little understood how back-firing took place, and consequently failed to devise means of preventing it.

For neutral liquors, the outer casing can be constructed from ordinary iron or steel, though the newer alloys may be used to prevent rusting; but when acid liquors are heated or evaporated, this must be protected with an acid-resisting covering such as enamel, silica ware, and even ebonite.

Refractories for lining the combustion chamber must be non-porous, acid-resisting, and capable of withstanding satisfactorily the high temperatures developed in the burner (above the melting-point of platinum) without cracking or melting. Though the temperature can be controlled within wide limits, it is obvious that high temperatures mean high consumption and more complete combustion. Complete combustion with low-temperature walls means that the heat must be conducted away at high rates. This is the reason why the new water-walled boiler furnaces are successful; but then the heat developed per unit volume in such furnaces is low compared with that of the submerged flame burner. The former develops about 100,000 B.Th.U. per c.ft. per hour, while the submerged flame burner develops 12 million B.Th.U. per c.ft. per hour. The original Bonecourt heating element (3 in. dia. by 3 ft.) completely consumed 100 c.ft. of coal gas per hour in the first 4 in. of its length, which works out to 3,500,000 B.Th.U. per c.ft. per hour.

Ordinary silica bricks fuse too easily to be employed extensively in the burner, though they can be used by arranging a suitable heat flow. Silica ware devitrifies in course of time, and carborundum, which has been used, is too porous even when made with thick walls. The most satisfactory material, so far, is alundum, but zirconia would be ideal if it could be obtained in suitable form.

The chemical industry abounds in heating problems, such as concentration of sulphuric and nitric acid solutions, crystallization of ammonium chloride, concentration of caustic soda, and the heating problems of acid processes generally, where efficiency is not the first consideration. Here submerged combustion will find its first real application, perhaps in the colour, dye, and artificial silk industries. Heating highly viscous solutions always has proved a difficult problem, but the submerged combustion combined with the air lift enables these solutions to be heated at a much greater rate, because of the violent circulation set up by the escaping gases. Further, chemical operations of oxidation and reduction either by suitable adjustments of the gas and air, or by passing oxidizing substances such as bromine through the burner, can be combined with this internal heating and stirring.

The greatest incentive to the development of the submerged flame burner is the use of all kinds of fragile material as containers in various chemical industries. Vessels of glass, earthenware, porcelain, silica ware, ebonite, rubber, concrete, brick, and enamelled iron, are not suitable for direct heating, nor is it always possible to use live steam, and closed coils are limited by the materials available for their construction. Here the submerged flame burner should find an immediate use. Interest in this system is aroused already in the dye and colour trade, which only awaits the marketing of a suitable small burner which can be applied to existing plant. Again, the agitation of large volumes of liquor is not easy, and the presence of awkward gears and motors working in noxious atmospheres does not seem to be the correct method. The burner not only supplies the heat, but the gases provide the energy for stirring. The burner-cum-airlift stirrer should revolutionize the colour works. It is portable, can be removed from vat to vat, and, suspended from a chain, can work like the pulsometer pump.

Discussion.

The CHAIRMAN suggested that in the present stage of development there was good reason why the submerged flame burner would not find universal application. There seemed to be no method of adapting it successfully and easily without bringing the products of combustion into the liquid itself; and this was a disadvantage. At the same time the burner seemed to have enormous possibilities as a means of raising steam for use in the chemical industry. Recently he saw an installation tested where the maximum amount of heat which could be obtained from the steam was used and where the first cost was not so important as the actual obtaining of all the heat possible. By concentrating on this, an efficiency of 93 or 94 p.ct. was obtained. But they would have to go a long way with the submerged flame before such figures as these were reached. Nevertheless, he believed there was an enormous future for this burner.

Dr. W. R. ORMANDY said he believed the possibilities of this burner were much greater than might be supposed at first sight. The type of evaporation for which this burner would undoubtedly be particularly applicable would be that of liquids which formed slime or non-conducting scales upon the surface of vessels which had to be heated by external transference.

Mr. OSCAR BRUNLER, Junr., said anybody could burn a flame under water if the flame was used without any pressure in the boiler; but when it came to burning a flame in water under a pressure of 150 or 350 lbs. per sq. in., technical difficulties were experienced which nobody could anticipate. The first plant was being erected in this country; and he hoped it would not be very long before full data would be available.

Mr. FEATHERSTONE HAMMOND observed that the submerged heating

process did not dilute liquor, which was a decided advantage. Another feature of the submerged burner was that the temperature could be controlled easily from inside, as compared with an external fire.

Dr. P. SCHOTZ remarked that there were many difficulties to be overcome before the burner could be adopted universally.

Prof. HOLMAN said that the paper suggested that the apparatus would be considerably less in weight than the ordinary one; and that, of course, would affect the cost of transport.

Prof. J. W. HINCHLEY looked forward to the submerged flame burner as an ideal system for constructing small sulphuric acid concentrating plants. There was one use for this burner which was immediately applicable and could readily be brought about—namely, the heating of large buildings. Cellar space in large buildings was becoming extremely valuable, and possibly in the case of the large stores they would soon see underground garages occupying the cellar space; but heating apparatus of this nature could be placed on the roof, owing to its small size.

Mr. F. J. BAILEY asked if very small burners could be constructed in order that a number might be used to spread the heat over a larger surface.

Mr. FEATHERSTONE HAMMOND said it was possible to design and construct burners having an output of 60 c.ft. of gas per hour. This was fairly small; and he did not know what applications Mr. Bailey had in mind which would call for a much smaller burner. When consideration was given to the manner in which the heat was spread so uniformly by this burner, and the enormous heat transfer, he did not see any immediate need for a great number of small burners being used together.

Mr. NORMAN SWINDIN, replying to the discussion, contended that a stage had been reached when those who were endeavouring to develop the apparatus should expect to receive some assistance from those in control of the vast industries. At the present time the chemical industry was asking for a burner of this description; and it was not a question of a limited use at all. On the contrary, the uses of it were legion.

INDUSTRIAL LIGHTING.

By W. J. JONES, M.Sc., A.M.I.E.E.

[From a Paper before the Institution of Chemical Engineers on Dec. 9 last—Mr. W. A. S. CALDER (Vice-President) presiding.]

There is an increasing demand for higher values of illumination at the present day; but it is often found that the increased facility in visibility which might be brought about by greater illumination is entirely negatived by the increase in glare introduced. Glare is one of the most indefinite quantities in illumination problems, and yet it is recognized as being present in a great many installations. The physiological effect may vary from a slight disturbance to complete paralysis of vision. We are all conscious of the blinding effect of glare; but even when no actual blinding takes place, the presence of glare mars the effect. It can be shown that under the best conditions the eye is able to appreciate a small difference in brightness of as little as 2 p.ct., but that when glare is present the degree of contrast just perceivable may be many times as great. Glare is more prevalent nowadays than ten to fifteen years ago, due to two reasons: The increased power of the lighting units; and the increased brightness of the light source itself.

It is self-evident that with good illumination workers are able to perform operations more quickly, due to the summation of the small elements of time which are saved on each operation. In one set of experiments, involving nine classes of work, the effect of increasing the illumination of 2·3 foot-candles to an average of 11·2 foot-candles brought about an average increase in production of 15·5 p.ct.; while the cost of the extra lighting was only 2 p.ct. of the pay-roll.

EFFECT OF VOLTAGE VARIATION.

As the voltage at the consumer's premises is frequently different from that at the supply station, and is liable to a certain amount of fluctuation, it is useful to know how the candle-power of a lamp varies with the voltage. Let us assume that the normal voltage of the lamp is 100, and that the luminous output is 100 units. Now if, owing to drop in mains or some other cause, the voltage be reduced to 90, the luminous output is reduced to 67 units. In other words, a reduction of 10 p.ct. in the voltage causes a 33 p.ct. decrease in the candle power of the lamp. The light emitted by a lamp depends on the temperature of its operation, and a change of temperature of the filament of 1 p.ct. produces a change of light output of 11 p.ct. When, as often happens, a 110-volt lamp is operated on 100 volts with the idea of extending its life, the filament of the lamp will be working below its normal temperature, and the resultant light output is very greatly reduced.

To get the best and most economic results from lamps—*i.e.*, light at the cheapest cost—it may be advisable, in some cases where electricity is expensive, to operate the lamp at a higher voltage than that at which it is rated, in spite of the fact that this will shorten its life. The policy adopted by some people of under-running in order to extend the life of their lamps will not necessarily give the cheapest results. A few units of large wattage are more economical than a large number of smaller ones.

It is not generally appreciated that, due to the deposit of dirt and dust, the illumination obtained from a lighting system will depreciate within three or four weeks by as much as 30 to 40 p.ct. under industrial conditions. It is, therefore, important that a regular maintenance system be inaugurated in works, to ensure that the lighting equipment is maintained at its normal efficiency.

There is little doubt that good lighting is as important in factory administration from a hygienic point of view as ventilation, cleanliness, and heating. The atmosphere of a factory with poor illumination is depressing and not conducive to work, while a well-lighted interior creates greater cheerfulness and desire to work.

DESIGN OF ILLUMINATION SCHEMES.

A number of essential factors enter into illumination design, and it perhaps appears such a complicated task that many designers have adhered to rule-of-thumb methods which, while adequate in some cases, may lead to unsatisfactory results when applied generally. The selection of lighting units, the coefficient of utilization, depreciation factor, and similar fundamental factors considerably influence the results. Three general methods can be used:

(*a*) *The Point-to-Point Method,* which can only be safely employed by a highly skilled technician, and which involves a knowledge of the polar curves of distribution of the fittings to be used, and in a large installation necessitates a tedious summation of the effects of the various fittings in the room. As it does not take into consideration the contributory effects of walls and ceilings, and is cumbersome in addition, it is now generally abandoned, but is still employed for special problems, such as lighting a restricted area from one light source. The calculations involve the inverse square law, and Lambert's "cosine law."

(*b*) *Watts per Square Foot.*—The watts per sq. ft. method is definitely a rule-of-thumb method, and intended for rough calculations. It does not take into consideration all the prevailing conditions.

(*c*) *The Lumen Method.*—This is now the recognized way of dealing with works problems. It has the advantage that the technical considerations, which are important as influencing the result, and which require the experienced judgment of the engineer, have been taken into account in the compilation of charts and tables, and, therefore, automatically receive due allowance in the lighting design. The method itself is based essentially on the fact that, of the lumens generated by the lamp itself, only a certain proportion actually reach the working plane.

STEPS IN DESIGN.

The four steps to be carried out in the design of a lighting scheme are:

(1) Decide the foot-candle illumination required.

(2) Select the type of lighting equipment best adapted to the location. This should take into consideration the nature of the work, requirements of light on vertical and horizontal surfaces, freedom from glare, &c.

(3) Determine the location of points, the mounting height and number of lighting units required. Under most conditions, the units should be spaced so that reasonably uniform illumination is provided. If we consider the installation of direct lighting units, the rule is to space the units one-and-a-half times their height above the working plane. Where units are installed near side walls for lighting work-benches, the distance from the wall should be half the mounting height. This rule is also applicable to the installation of semi-enclosed and totally enclosed units.

(4) Ascertain the size of lamp which will provide the foot-candles desired. This is obtained by one or other of the methods referred to earlier.

"The Salesman's Diary," 1928.

The new edition of the "Salesman's Diary and Handbook," which was published last month, and is obtainable at the Offices of the "GAS JOURNAL," 11, Bolt Court, E.C.4, at 3s. 6d. net, post free, has a wider scope than previous issues, but is of smaller dimensions. The size is now 5¼ in. by 3¾ in., so that the handbook can be carried conveniently at all times. In spite of this reduction in size, however, there have been extensive additions to the information contained in former issues; an entirely new section being devoted to coke for room heating, water heating, central heating, steam raising, and transport. A valuable table in this section relates to the sizes of coke, which have proved most suitable for different classes of domestic hot water boilers. Regarding the latter, there are notes on fixing, which, it is thought, will be welcome. It is obvious that the publishers of the Diary have spared no efforts to produce a mass of reliable information calculated to be of daily service to gas salesmen.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Why Not a Gas Chemists' Association?

SIR,—May I beg the courtesy of your columns to ventilate the need for a "Gas Chemists' Association?"

Such a request will come as a shock to many in view of the large number of societies already existing; but surely the latter fact, instead of being a deterrent, only emphasizes the need.

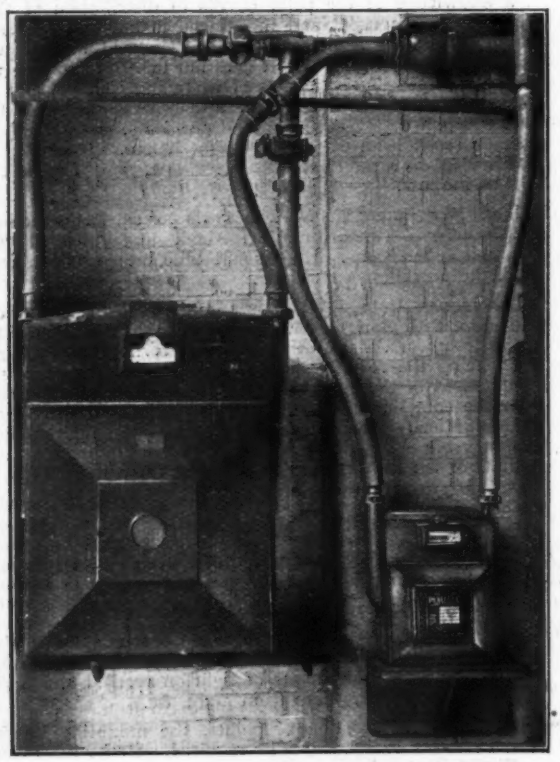
We have the Institution of Gas Engineers, the Institution of Petroleum Technologists, Dyers and Colourists, the Iron and Steel Institute, the Society of Chemical Industry, the Chemical Society, the Institute of Fuel, and metallurgical societies, which to a certain extent all overlap. The poor gas chemist cannot afford to belong to all of them; but nevertheless he is expected to know something of the work each society covers. A gas chemist needs a society where he can meet with all these subjects—so why not a Gas Chemists' Association?

"GAS CHEM."

Dec. 30, 1927.

A Meter Comparison.

SIR,—We think the accompanying illustration will be of interest to your readers, as it is reproduced from an actual photograph taken in a factory in London.



The meter shown on the left is one of the usual type of "lights" meter with a capacity of 480 c.ft. per hour. New tenants took the factory; and as the old meter was about due for overhaul, the Gas Company decided to instal one of the new "Perfecta" high-capacity meters shown on the right, and this has a capacity of 420 c.ft. per hour. Comment would be superfluous.

PERFECTA METERS, LTD.,
H. S. RUSSELL,
Sales Manager.

Nightingale Grove,
Hither Green, London, S.E. 13,
Dec. 23, 1927.

Nuneaton Gas and a Two-Part Tariff.

SIR,—With reference to Mr. Helps' letter in your issue for Dec. 14 last, replying to my communication published previously—see "JOURNAL" for Nov. 30, 1927, p. 625—I made no suggestion that Mr. Helps was not entitled to any credit for his advocacy of a fixed standing charge *plus* a low charge for gas. My object in referring to the National Gas Council and other bodies was to remind your readers that the merits of the two-part tariff were being actively investigated by public bodies as well as by gas engineers. The greater the number of individual gas engineers converted to the principle of a two-part tariff, the better.

With regard to Point No. 2, if Mr. Helps did not mean that the 4d. per therm was to be part of the two-part tariff, then I do not know what he did mean. His words were as follows:

> If, for example, all the domestic users of coal in Nuneaton would each agree to pay 1s. per week for the incidental expenses, &c., connected with gas, it could be sold to them at its actual cost price; and the more they used, the less per therm would it cost them—this is the essence of gas business.

With regard to Point No. 3, it may be that I am misunderstanding Mr. Helps, and that Mr. Helps is not misunderstanding me. Again I repeat his words:

> One shilling per week would provide every other charge, including profit on capital, but excepting the cost of manufacture, which would not amount to much more than 4d. per therm at the present moment, and less later.

According to the Board of Trade returns for 1926, Mr. Helps has 5654 consumers. At 1s. per week—£2 12s. a year—the revenue from these customers would be £14,700. Quoting the Board of Trade returns again, Mr. Helps sold 332,534 therms. Divided over this amount of gas, I make the revenue from the fixed charge amount to 10·6d. per therm.

I assumed that the words quoted above meant that, if Mr. Helps was assured of a revenue of £14,700 a year, *plus* any further customers he may get at £2 12s. per year, he could afford to sell gas at 4d. per therm, which he refers to as the actual cost price.

If my interpretation of Mr. Helps' system—viz., that it is a two-part one, and that the above is the economic effect of it—is incorrect, then, of course, I unreservedly withdraw my two letters.

ENGINEER.

Dec. 23, 1927.

Mr. Helps Will Reply.

SIR,—Permit me to say that the delay in replying further to "Engineer" and "Accountant" is due to the holidays.

Thanks to both of these gentlemen my Christmas has been brighter than ever, and I am confident that when my reply comes it will do them both full justice.

GEORGE HELPS.

Nuneaton Gas Company,
Queen's Road, Nuneaton,
Dec. 31, 1927.

"Gas Journal" Calendar, 1928.

SIR,—May I thank you for this Calendar, and at the same time add that in my opinion the information contained therein for the current year is not only most useful, but is presented in a very attractive form. I venture to express the hope that those who are fortunate enough to obtain a copy will carry it about with them, and make use of it at every opportunity.

There is one matter I would like to call attention to: on p. 155, referring to the comparison of horizontals and verticals at Portsmouth. . . . "The net total cost per gas therm (including net for coal, labour, maintenance, and capital charges) as 1·69d., &c." This statement is surely not complete? It would be most helpful to have all the details as to how this figure is arrived at.

I have referred to the paper by Mr. Carmichael, but this does not help me.

GEORGE HELPS.

Nuneaton Gas Company,
Queen's Road, Nuneaton,
Jan. 2, 1928.

REGISTER OF PATENTS.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Dec. 21.]

Nos. 33,502—34,265.

CARPENTER, C.—"Operating gas producers." No. 34,119.
DAVIES, G.—"Gas mantles." No. 34,055.
JONES, G. CELLAN-.—"Carbonization of coal." No. 33,602.
KEITH, G.—"Regulator for gas burners." No. 33,978.
KEITH, G.—"Gas burner fittings." No. 34,044.
KEITH & BLACKMAN COMPANY, LTD., J.—See Keith, G. Nos. 33,978, 34,044.
KOPPERS COMPANY.—"Gas purification." No. 34,139.
RADIATION, LTD.—"Gas-heated cooking apparatus." No. 34,016.
SOUTH METROPOLITAN GAS CO.—See Carpenter, C. No. 34,119.
WOODALL-DUCKHAM (1920), LTD.—"Boiler furnaces." Nos. 33,716, 33,717.
YATES, H. J.—See Radiation, Ltd.—No. 34,016.

[Extracted from the "Official Journal" for Dec. 30.]

Nos. 34,266—35,047.

BARRY, V. M.—"Distillation of carbonaceous materials." No. 34,365.
BRUNLER, O.—"Apparatus for heating by submerged flames." No. 34,659.
DEAN, W.—"Gas washing boilers." No. 34,779.
EWART, J. H.—"Water supply valves of water heaters." No. 34,958.
FALKNER, A. J.—"Control for gas burners." No. 34,372.
FLETCHER, C. G.—"Device for preventing leakage in gas pipes." No. 34,430.
GLOVER, W. T.—"Retort house governors." No. 35,021.
GLOVER, W. T.—"Dry gas meters." No. 35,022.
JACOT, C. A.—"Automatic gas tap controls." No. 34,507.
KIRKE, P. ST. G.—"Waste-heat boilers." No. 34,695.
LAHEY, J. J.—"Latches for gas valves." No. 34,646.
LAING, B.—"Distillation of carbonaceous materials." No. 34,825.
LAMBERTY, C. H. H.—See Barry, V. M. No. 34,365.
LODGE-COTTRELL, LTD.—"Precipitation of suspended particles from gaseous fluids." No. 34,748.
METERS, LTD.—See Glover, W. T. Nos. 35,021, 35,022.
MICHAELSON, B. L.—See Lahey, J. J. No. 34,646.
NIELSEN, H.—See Laing, B. No. 34,825.
PARKES, D. W.—"Treatment of ammonia liquors." No. 34,933.
POWER GAS CORPORATION, LTD., and RAMBUSH, N. E.—"Apparatus for treating gases." No. 34,394.
ROBINSON, H. W.—See Parkes, D. W. No. 34,933.
SOC. ANON. DE MATERIEL DE CONSTRUCTION.—"Manufacture of sulphate of ammonia." No. 34,688.
SPENCER-BONECOURT, LTD.—See Kirke, P. St. G. No. 34,695.
TIROCKE, W., and TUREK, J.—"Automatic gas shut-off device." No. 34,367.

MISCELLANEOUS NEWS.

STATISTICS OF RATES AND CHARGES.

Some of the Latest Figures.

From Mr. W. Allison Davies, Borough Treasurer of Preston, we have received a copy of the 43rd annual statement of rates levied in various towns, together with charges for gas, water, and electricity, and profits and losses on municipal undertakings which affect the rates. The particulars with regard to gas supplies embrace the charge per 1000 c.ft., as well as per therm, where the Gas Regulation Act has been adopted, and the declared calorific value. In his useful work of compiling information upon these important subjects, Mr. Davies is, of course, assisted by the officers of the various local authorities concerned, whose co-operation he acknowledges. The tables now to hand relate to the financial period 1927-28; and particulars are given with regard to 84 county boroughs, 98 boroughs, 91 urban districts, and 28 Metropolitan boroughs. From year to year further names are included; and on the present occasion quite a number of additions have been made.

RATING STATISTICS.

The figures relating to rating statistics show the populations according to the census of 1921 and those estimated at Midsummer, 1926. Then follow the area, the rateable value—total for 1926-27 and 1927-28 and per head of the 1926 estimated population—the amounts produced by a penny rate, the rates per head, the total rates in the pound required, the relief from undertakings, and the total rates levied for 1926-27 and 1927-28. The average rates levied for the financial period 1927-28 in the case of the first three groups into which the return is divided are as follows: County boroughs, 14s. 8¾d. in the pound, as compared with 14s. 2d. a year ago; boroughs, 14s. 3¾d., against 13s. 10⅜d.; and urban districts, 16s. 4½d., as against 15s. 3¾d.

In the case of the Metropolitan boroughs, the alterations, generally speaking, though numerous, are not of great extent; but the approximate average rates in Southwark have come down from 15s. 6¼d. to 13s. 2⅝d. Several large increases noted a year ago have been maintained. Westminster, with 9s. 7d. in the pound, is still the lowest rated of the Metropolitan boroughs. It is, indeed, the only one in which the figure is below 10s. Camberwell has managed to knock 1s. off, which brings the total down to 12s. 4d.; and there are falls of 10d. (from 14s. 8d. to 13s. 10d.) in Greenwich and of 9d. (from 15s. to 14s. 3d.) in Deptford.

HIGH AND LOW FIGURES.

A glance through the tables fails to reveal any place with higher rates than Gellygaer, where the figure has in twelve months gone up from 26s. 1d. to 32s. 4d. in the pound. Other towns or districts with rates of 20s. or more in the pound include: Barnsley, 22s. 3d.; East Ham, 22s. 8d.; Gateshead, 22s. 3d.; Merthyr Tydvil, 30s. 7½d.; Norwich, 20s. 6d.; West Ham, 24s. 6d.; Chesterfield, 20s.; Hartlepool, 21s. 4d.; Jarrow, 20s. 6d.; Keighley, 20s. 6d.; Leyton, 22s. 4d.; Llanelly, 23s. 7d.; Whitehaven, 20s. 4d.; Abercarn, 20s.; Aberdare, 30s.; Abertillery, 26s. 4d.; Ashington, 21s. 4¾d.; Blaydon, 25s. 8d.; Caerphilly, 28s.; Eston, 22s.; Felling-on-Tyne, 24s. 8d.; Hebburn, 23s.; Maesteg, 26s. 11d.; Pontypridd, 29s. 6d.; Rhondda, 30s.; Stanley, 20s. 8d.; Tredegar, 20s. 4d.; Walthamstow, 25s.; Whickham, 24s. 1d.; Wombwell, 25s. 9d.; Bethnal Green, 22s. 4d.; and Poplar, 25s.

On the other hand, the rates are less than 10s. in the pound at: Blackpool, 7s. 6d.; Bournemouth, 8s. 9d.; Darlington, 9s.; Eastbourne, 9s. 7d.; Oxford, 7s. 7¾d.; Southport, 8s. 8d.; Bexhill, 8s. 4d.; Tunbridge Wells, 9s. 10d.; Bebington and Bromborough, 9s. 9d.; Epsom, 9s. 7d.; Hendon, 8s. 6d.; Sutton (Surrey), 8s. 6d.; and Westminster, 9s. 7d.

MUNICIPAL UNDERTAKINGS—PROFIT AND LOSS.

It is seen from another section of the return that the rates levied in the following towns have in the period under review been reduced to the extent of 1s. or more in the pound by transfers from municipal undertakings, &c.; but the figures already quoted are those of rates actually levied, after allowing for any such transfers: Doncaster, 1s. 5¼d.; Leeds, 1s.; Walsall, 1s. 6d.; Wigan, 1s. 9¼d.; Great Yarmouth, 1s. 2¾d.; Nelson, 1s. 1¾d.; Stafford, 1s. 1¾d.

Against this, there are a number of other places in which deficiencies on municipal trading undertakings have been incurred to an extent necessitating rates in aid amounting in the aggregate to 1s. in the pound or over. Such deficiencies are noted in the cases of: Blackburn, 1s. 0¼d.; Merthyr Tydvil, 2s. 7¼d.; Middlesbrough, 1s. 2d.; Newport (Mon.), 1s. 4¼d.; Preston, 1s. 2⅝d. Bacup, 2s. 2½d.; Batley, 3s. 1¾d.; Buxton, 1s. 4d.; Colne, 1s. 0¼d.; Harrogate, 1s. 0⅝d.; Keighley, 4s. 8⅝d.; Llanelly, 2s. 3¼d.; Abercarn, 2s. 10d.; Aberdare, 3s.; Caerphilly, 1s. 5⅝d.; Colwyn Bay, 1s. 3¼d.; Eston, 1s. 2½d.; Gellygaer, 1s. 6⅛d.; Pontypridd, 1s. 6¼d.; Rhondda, 1s. 1d.; Walthamstow, 2s. 0¼d.; Wombwell, 2s. 9⅛d.; and Worksop, 1s.

The return includes five places in which the profits transferred from gas undertakings in relief of rates reached £10,000; this comparing with four instances in each of the two immediately preceding years. The places on this occasion are: Belfast, £11,460; Blackpool, £10,000; Nottingham, £23,736; Salford, £10,000; and Nelson, £13,041.

On the other hand, there are seven cases of transfers from the rates to municipal gas undertakings in respect of deficiencies, which compares with five instances for the preceding year. The places on the present occasion are: Batley, £4500; Morley, £1000; Abercarn, £1000; Rhondda, £8139; Scunthorpe and Frodingham, £1000; Sutton-in-Ashfield, £1055; Swadlincote, £1040.

GASSING FATALITY AT TOOTING.

How the fracture of a gas main, due to the recent abnormal weather conditions, caused the death of an elderly couple, was explained at the inquest at Battersea recently on Charles Leahy and Clara Bristow, of 96, Graveney Road, Tooting. Examination by workmen of the Wandsworth, Wimbledon, and Epsom District Gas Company, it was stated, showed a fracture of the gas main laid beneath the pavement outside the house.

Mr. C. M. Croft, Chief Engineer of the Company, said that the pipe, which was 3 in. in diameter, was in perfectly good order, and had been in service for about twenty-three years. It was embedded in clay and was well protected from vibration. The breakage, in his opinion, was undoubtedly caused by the recent frost and the subsequent thaw. Mr. Croft expressed the opinion that possibly the gas escaped into the house along a channel which had been made for the purpose of ventilating a sewer.

The CORONER (Mr. Ingleby Oddie): What can be done to guard against accidents such as this in the future?

Mr. *Croft*: I think that in all but very abnormal times such an accident would never occur. When it does occur, in ninety-nine cases out of a hundred the escape is into the road or into a sewer, and it is detected and put right, without anybody being the worse. In this instance it did not escape by the nearest way. It went into a house some distance off. There was another fracture of a main in a different part of the district on the same day, but it occurred in the roadway, and was put right before any harm was done.

Recording verdicts of "Accidental death," the Coroner said that these accidents were extremely rare, and he did not see how the Gas Company could be blamed for this one.

DIARIES, CALENDARS, &c.

Additions have been made during the past week to the diaries, calendars, &c., of which receipt was acknowledged last week.

The Torbay Paint Company, Ltd., have again sent us one of their midget pocket diaries.

The Woodall-Duckham Vertical Retort and Oven Construction Company, Ltd., have presented us with a choicely leather-bound desk pad. On the left-hand side is a diary in book form, with pages interleaved with blotting-paper, and prefaced by much information useful day by day to the business man.

Simon-Carves, Ltd., of Manchester, send us their block calendar, with an inscription below each date.

A neat desk blotting-pad has been received from Messrs. Alder & Mackay, Ltd., of Edinburgh. Unobtrusively on it they refer to their various productions.

Crossley Bros., Ltd., have forwarded a useful wall calendar, with blocks of dates, the figures being printed in red. We read that the well-known firm was established in 1866; and it is also noted that over 100,000 engines have been sold, of different sizes, and employing gas or oil.

Evesons (Coal), Ltd., of 134, Edmund Street, Birmingham, ask us to announce that refills for the "Magnet" Calendar for 1928 can be obtained from them on application.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Jan. 2.*

The volume of business passing in the London tar products market is not large, but prices generally continue steady. Current values are as follows:

Pitch, about 90s. per ton; creosote, 9d. per gallon; pure benzole, 1s. 5d. to 1s. 6d. per gallon; pure toluole, about 1s. 10d. per gallon; 95/160 solvent naphtha, 1s. 3d. per gallon; pyridine, about 6s. per gallon.

Tar Products in the Provinces.

Dec. 23.

The markets for tar products are very quiet indeed, and it is not anticipated that there will be great demand before the New Year.

Pitch is steady. There is a certain amount of Continental inquiry; but up to now consumers have indicated their intention of waiting for lower prices. On the other hand, there does not appear to be any anxiety whatever on the part of makers on this side to sell, and it is probable that the quantity still remaining to be sold at the end of June next is unusually small.

In creosote, the position is unchanged, and demand continues.

Naphthalene remains firm.

Water-white products are still at present. Crude carbolic continues in good demand for delivery over the whole of next year.

There is no alteration in the market for crystals carbolic. The best qualities of cresylic acid are still selling at full prices.

The average prices of gas-works products during the week were: Gas-works tar, 61s. 6d. to 66s. 6d. Pitch—East Coast, 85s. to 86s. f.o.b. West Coast: Manchester, 80s. to 81s.; Liverpool, 83s. to 83s. 6d.; Clyde, 84s. to 85s. Benzole, 90 p.ct., North, 1s. 1d. to 1s. 2d.; crude, 65 p.ct. at 120° C., 10d. to 10½d., naked at makers' works; 50/90 p.ct., naked, North, 1s. 3d. to 1s. 4d. Toluole, naked, North, 1s. 4d. to 1s. 5d. nominal. Coal-tar crude naphtha, in bulk, North, 7½d. to 8d. Solvent naphtha, naked, North, 9½d. to 10d. Heavy naphtha, North, 10d. to 1s. Creosote, in bulk, North, liquid, 7½d. to 7⅝d.; salty, 7⅝d. to 7¾d.; Scotland, 7¾d. to 7⅞d. Heavy oils, in bulk, North, 8¾d. to 9¼d. Carbolic acid, 60 p.ct., 2s. 4d. to 2s. 5d. prompt. Napthalene, £13 to £15; salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

Jan. 2.

There has been no alteration in the markets for tar products during the past week, and business remains very quiet indeed.

Pitch is still steady. Continental inquiry continues; but at present consumers are unwilling to pay the prices asked. Little or no pitch is being offered by makers in this country.

There has been no alteration in the position of creosote. The market continues firm.

Naphthalene is still firm, and makers are adhering to their advanced prices.

Water-white products continue very quiet. Crude carbolic is still in good demand for either prompt or forward delivery. Cresylic acid is steady. There is no alteration in the market for crystals carbolic.

There are no alterations to record in the prices, which remain as quoted in the report dated Dec. 23, as above.

CONTRACTS OPEN.

Bunkers (Steel or Ferro-Concrete) and Mechanical Plant.

The Spenborough Gas Department invite tenders for steel brick-lined or ferro-concrete bunkers, together with handling and screening plant for same. [See advert. on p. 50.]

Coal.

The Slough Gas and Coke Company invite tenders for the supply of 16,000 tons of coal. [See advert. on p. 50.]

Stores (including Tools, Iron, Oils, &c.).

The Gas Committee of the Bradford Corporation invite tenders for the supply of stores required for their several departments. [See advert. on p. 50.]

Tubes, Pipes, Castings, &c.

The Gas Committee of the City of Bradford invite tenders for the supply of pipes, castings, &c. [See advert. on p. 50.]

COAL TRADE REPORTS.

From Our Own Correspondents.

NORTH-EAST COAST.

Activity during the holiday season has, as usual, been confined largely to routine business. Shipments for the Christmas and New Year period had been mostly arranged in advance. Consequently there has been little demand for prompt cargoes in the last fortnight, and production has been curtailed.

The general demand for next year shows little change, and buyers abroad are still reluctant to contract for very far ahead. A certain amount of business for the whole year has been quietly fixed up in recent weeks, but prices are not at all remunerative on present prospects.

Nominal quotations show little change. Wear Special gas makes ask 15s. 9d. to 16s. 3d., and best qualities are 15s. 9d. f.o.b.; seconds, 13s. 6d. to 14s.; Durham unscreened coking is fairly firm at 13s. 9d. to 14s.; and unscreened steams are 14s. 6d. for best qualities, and 13s. 3d. to 13s. 9d. for ordinaries. Northumberland steams are quoted at 14s. direct for best screened sorts. Gas coke has eased off slightly, and is quoted at about 22s. f.o.b. for shipment.

YORKSHIRE AND LANCASHIRE.

Gas coals are moving freely under contract, and one or two sales have been made recently for deliveries to commence during the coming summer at figures lower than those which operated during the last contracting period. Whether the new proposals now before the collieries will have any effect on this market is a rather interesting question.

The general industrial demand remains stationary, with indications that contracts have been renewed for delivery over the next twelve months at very low figures, the majority of which do not show a profit to the collieries at present rates of working.

The export section is more optimistic; but so far not much increased tonnage is involved.

The recent severe weather has caused increased business in domestic fuel; but there has not been a sufficient rush of orders to prevent prompt delivery, and it remains to be seen whether a continuance of the present climatic conditions will result in increased working hours at the pits.

The following are the Humber bunker and export prices, f.o.b. usual shipping ports: South Yorkshire—Hards, Association, 16s. 3d.; screened gas coal, 16s. to 17s.; washed trebles, 16s. 6d. to 17s.; washed doubles, 16s. to 16s. 6d.; washed singles, 15s. 9d. to 16s.; washed smalls, 11s. 6d. to 12s.; rough slack, 9s. to 10s.; smithy peas, 17s. to 18s. per ton. West Yorkshire—Hartley's (f.o.b. Goole), 15s. to 16s.; screened gas coal, 15s. to 16s.; washed trebles, 16s. 6d. to 17s.; washed doubles, 15s. 9d. to 16s.; washed singles, 15s. 3d. to 15s. 9d.; washed smalls, 11s. 6d. to 12s.; unwashed trebles, 15s. 9d. to 16s.; unwashed doubles, 11s. 6d. to 12s.; rough slack, 9s. to 10s.; coking smalls, 9s. to 10s. per ton. Derbyshire and Nottinghamshire—Top-hards, 16s. 6d. to 17s. 6d.; washed doubles, 15s. 9d. to 16s.; washed singles, 15s. 3d. to 15s. 9d.; washed smalls, 11s. to 12s.; unwashed doubles, 12s. to 12s. 6d.; rough slack, 10s. to 10s. 6d. per ton. Yorkshire, Derbyshire, and Nottinghamshire—Screened steam coal, 14s. 6d. to 15s. 6d.; gas coke, 24s. to 25s. 6d.; furnace coke, 17s. 6d. to 18s. 6d. per ton.

MIDLANDS.

At most of the pits in this area arrangements were made to "play" for the greater part of the Christmas week. There was no urgency about the resumption. The "cold snap" preceding Christmas had given a sharp impetus to the demand for certain classes of house coal. Stocks on wharves and consignments in transit were greatly depleted. But they quite sufficed to meet the rush without the necessity of calling for reinforcements. Whatever strain there was fell on the distributive plant.

So far as available supplies were concerned, there was no stringency materially to change market values, apart from special cases in which particular qualities were required in larger quantities than were at once forthcoming. The stiffening tendency of slacks continued; central heating requirements increasing. In Birmingham and other populous centres fresh output records were set up at the gas and electricity works. Since Christmas there has been more pressure for contract deliveries owing to apprehensions that in prevailing wintry conditions undue levies might be made on reserves. No market effects were perceptible; new sales being as difficult to negotiate as previously.

Provision had been made before Christmas for the restarting of industry when the holiday was over. Notwithstanding difficulties of transport, there has been no market tension since. Merchants' stocks of house coal have been very considerably relieved, and in this department the call on collieries has become general where it had been sporadic. A large number of wagons which had been detached for the Christmas traffic are now set free for the transport of coal.

TRADE NOTES.

A Pitch Chart.

Messrs. Victor Blagden & Co., Ltd., of 4, Lloyds Avenue, E.C. 2, have published a useful chart showing the prices of pitch from 1919 to the end of last year. It is seen from this that the peak prices occurred in September, 1920, March, 1923, and November, 1926. The lowest point reached was in September, 1924. Accompanying the chart is a blank form for completion to the end of 1936.

"Bitumastic" Enamel as Anti-Corrosive.

In the current issue of the "Bitumastic" Bulletin—the house organ of Messrs. Wales Dove Bitumastic, Ltd., of Newcastle-upon-Tyne—it is stated that there is at present being laid in the United States a 20-in. steel pipeline covering a distance of 250 miles. It is for the Empire Gas and Fuel Company. "Bitumastic" enamel has been selected as the coating to prevent corrosion; and the Company have ordered 2400 tons.

STOCK MARKET REPORT.

It will be remembered that during the year 1926 the long drawn-out coal stoppage had an adverse effect on the prices of Gas Stocks; and, with one or two exceptions, the capital stocks of the various companies showed considerable depreciation on the prices for the year 1925. In the past year, however, the movements have been the other way, and, speaking generally, have more than discounted the fall in values which occurred in 1926. Another factor which has helped to keep up prices is the more reasonable attitude of the authorities with regard to standard prices. Investors may have greater reliance on the existing standards being more or less maintained in the future, provided there is no extravagant distribution of dividends, which, having regard to the present keen competition with which companies have to contend, is hardly likely in a well-managed undertaking.

Of the companies operating in England, the greatest appreciation in the quotations is that of the Commercial Company's ordinary stock, which shows a rise of 13½ points as compared with the price of the former 4 p.ct. stock a year ago. There is little doubt that this improvement is partly due to the Company's new statutory powers. The Tynemouth consolidated has risen 13 points, for which the prospective amalgamation with the Newcastle and Gateshead Company is possibly partly responsible. Liverpool ordinary come next with 9 points rise, South Metropolitan with 8 points, and the Gas Light ordinary with 7 points. Of the exceptions to the rule, South Shields consolidated has dropped 13 points, which is rather remarkable, as it follows a fall of 14 points a year ago. Maidstone 5 p.ct. has fallen 5 points, following 8½ points drop in 1926, and Derby consolidated is 4 points down on the year.

Of the companies operating abroad, Imperial Continental capital stock rose 13 points, and Montevideo ordinary 10½ points. Oriental ordinary, to which considerable attention has been given during the past month, rose 8 points, and the more promising prospects of the Primitiva Company have brought about a rise of 5s. 3d. in the £1 shares.

It will be seen that the prices of the lowest and highest transactions during the past year have been inserted in the last column of the Table. The variations have not been so wide as they were during the previous year. The most prominent are the Commercial ordinary 79½-95, Imperial Continental 130-146, Primitive 14s.-21s. 7½d., Continental Union 28-37, Brighton and Hove, 102-112, and Alliance and Dublin 81-94. The figures for the Bristol, Derby, Newcastle, Sheffield, South Shields, and Tynemouth Companies are not available.

The following transactions were recorded during the week:

On Wednesday, Bombay 22s. 1½d., Gas Light and Coke 93⅜, 93¾, 94, Oriental 109, Primitiva 19s. 3d., 19s. 4¼d., 19s. 6d., South Metropolitan 103, South Suburban 104, 104½. Supplementary prices, Southgate and District additional ordinary 101⅜, 102½.

On Thursday, Bournemouth 5 p.ct. 13, British 111½, Colonial 8 p.ct. preference 21s. 6d., Gas Light and Coke 93½, 93⅝, 94, 3½ p.ct. maximum 63, 4 p.ct. preference 77½, 3 p.ct. debenture 59¼, 60, Oriental 110, Primitiva 19s. 3d., 19s. 6d., 19s. 7½d., 19s. 9d., 19s. 10½d., South Metropolitan 103¾, 6½ p.ct. debenture 103½. Supplementary prices, Felixstowe "A" original 130, "B" additional 98½, Herne Bay 6 1/16.

On Friday, British 112, Continental Union 28, European 7⅝, Gas Light and Coke 93⅜, 94, 94½, 3 p.ct. debenture 60⅜, Primitiva 19s. 7½d., 19s. 9d., 19s. 10½d., 20s., South Metropolitan 103¼, South Suburban 5 p.ct. debenture 94. Supplementary prices, Hampton Court 5 p.ct. 102½, 103¼.

As expected, there was considerable activity in the Money Market at the end of last week. The demand for money for window dressing purposes was very extensive, and up to 5 p.ct. was freely paid for loans over the week-end. Overnight money was abundant at from 3 p.ct. down to 2½ p.ct. Treasury Bills were allotted at the lower rate of £4 5s. 4·09d. p.ct., being about 1s. 8½d. p.ct. below that of the previous week. This caused a slightly easier tendency in the discount rates. A fairly large business was reported in the Foreign Exchange Market in connection with the squaring-up of accounts at the end of the year. Dollars were in greater demand, and the New York rate moved against Sterling, closing at 4.88¼. There was a slight decline in Italian lire, which finished at 92.30¼; the Madrid rate closed at 28.83; French francs were steady at 124; and Dutch florins were quoted higher at 12.07⅝.

Silver was easier on Chinese sales, the cash price declining to 26⅜d. per oz. Gold also was ½d cheaper at 84s. 11d. per oz.

The Bank Rate is 4½ p.ct., to which it was reduced from 5 p.ct. on April 21. The Banks' deposit rate is 2½ p.ct., and the deposit rates of the discount houses are 2½ p.ct. at call and 2⅝ p.ct. at notice.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Aft. Yr	Dividends. Last Hf. Yr	NAME.	Quotations. Dec. 30.	Rise or Fall on Week.	Transactions Lowest and Highest during the year 1927.
£			%p.a	% p.a.				
171,978a	Stk.	Sept. 8	6	5	Aldershot 5 p.c. max. C.	68—78	..	70- 73½
999,992	,,	,,	4	4	Do. 4 p.c. Pref.	69—72	..	67½- 71½
1,451,888	,,	Sept. 29	7	7	Alliance & Dublin Ord.	90—94	..	81- 94
274,000	,,	July 14	4	4	Do. 4 p.c. Deb.	64—67	..	64 67½
522,654	,,	Aug. 15	—	7	Barnet Ord. 7 p.c.	105—108	..	103¾- 104½
800,000	1	Oct. 13	1/7½	1/7½	Bombay, Ltd.	21/6—23/6	..	21/—22/10½
170,000	10	Aug. 25	8½	8½	Bournemouth 5 p.c.	12½—13½	..	12⅝- 13½
500,050	10	,,	7	7	Do. B 7 p.c.	12—12½	..	12—12½
275,000	10	,,	6	6	Do. Pref. 6 p.c.	10½—11½	..	10½—11½
50,000	Stk.	June 29	3	3	Do. 3 p.c. Deb.	55—58	..	55- 56½
162,025	,,	,,	4	4	Do. 4 p.c. Deb.	75—78	..	74⅝—77½
357,900	,,	Aug. 25	—	7½	Brighton & Hove 6 p.c. Con.	108—111	..	102—112
341,800	,,	,,	—	6/8/6⅔	Do. 5 p.c. Con.	98—101	..	92½—100
1,327,500	,,	July 28	5	5	Bristol 5 p.c. max.	87—88a	..	..
855,000	,,	Sept 29	7	8	British Ord.	110—113	+1	105½—112
100,000	,,	Dec. 22	7	7	Do. 7 p.c. Pref.	114—117*	..	113¾—116½
120,000	,,	,,	4	4	Do. 4 p.c. Red. Deb.	72—75*	—2	68 -76½
300,000	,,	,,	—	33/2	Do. 5 p.c. Red. Deb.	93—96*	—2	95
100,000	10	Nov. 24	8	6	Cape Town, Ltd.	7—8	..	7⅞—8⅝
100,000	10	Oct 27	4½	4½	Do. 4½ p.c. Pref.	6—7	..	6—6⅞
150,000	Stk.	Dec. 22	4½	4½	Do. 4½ p.c. Deb.	70—75*	..	70 -74½
636,860	,,	July 23	6	6	Cardiff Con. Ord.	100—103	..	100½—103
287,860	,,	June 29	7½	7½	Do. 7½ p.c. Red. Deb.	103—106	..	102
157,150	,,	Aug. 11	6½	5	Chester 5 p.c. Ord.	87—92b	..	..
79,185	1	Oct. 13	1/2/-	1/2/-	Colombo Ltd. Ord.	31/—33/-	..	29/8- 33/6
24,495	1	,,	1/4½	1/4½	Do. 7 p.c. Pref.	20/ —22/-	..	21/6- 21/9
231,490	1	Oct. 13	1/9⅜	1/9⅜	Colonial Gas Assn. Ld. Ord	24/—26/-	..	25/—26/9
173,900	1	,,	1/7½	1/7½	Do. 8 p.c. Pref.	20/—22/-	..	20/9—23/7½
3,073,289	Stk.	July 14	—	5	Commercial Ord.	93—95	..	79½- 95
475,000	,,	Dec. 22	3	3	Do 3 p.c. Deb.	55—58*	—1	55—59⅜
900,000	,,	Sept. 29	11	11	Continental Union, Ltd.	28- 33	..	28- 37
900 000	,,	,,	7	7	Do. 7 p.c. Pref.	87 92	..	81—90
787,560	,,	Aug. 11	6½	6½	Croydon sliding scale	98 - 101	..	97—101
403,100	,,	,,	5	5	Do. max. div.	81 84	..	78—83½
492,270	,,	Aug. 25	9	6	Derby Con.	103 -105a	..	..
55,000	,,	June 29	4	4	Do. Deb.	73—75a	..	..
309,000	,,	Aug. 25	5	5	East Hull Ord. 5 p.c.	78 81	..	78
50,000	,,	June 16	5	5	Eastbourne 5 p.c. Deb.	90 - 95	..	..
1,002,180	10	Sept. 29	†3	†4	European, Ltd.	7⅞ 8½	..	6—8½
2,747,460	Stk.	July 28	5	5	Gas Light & Coke 4 p.c. Ord.	93—95	+4½	86—94½
1,600,000	,,	,,	3½	3½	Do. 3½ p.c. max.	62—64	..	59—63¾
4,157,020	,,	,,	4	4	Do. 4 p.c. Con. Pref.	76—79	..	75½—79
5,602,620	,,	Dec. 22	3	3	Do. 3 p.c. Con. Deb.	59—61*	—1	58—61½
181,315	,,	,,	6	6	Do. 6 p.c. Br'tf'd Rd. Db.	100 -103*	—2	99½—104
1,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb.	98—100*	—1	99—101
42,000	,,	—	7½	7½	Do. 7½ p.c. Ilford Deb.	..	..	..
82,500	,,	Aug. 25	6⅝	6⅝	Hastings & St L. 5 p.c. Conv	89—92	+1	91—92½
358,740	,,	,,	5½	5½	Do. 3½ p.c. Conv.	70 - 73	—2	67½—71
70,000	10	Oct. 13	†10	†10	Hongkong & China, Ltd.	12—13	..	12⅜—13
178,200	Stk.	Aug. 25	5	5	Hornsey Con. 3½ p.c.	75—78	..	67—68½
1,976,000	,,	Nov. 10	10	10	Imperial Continental Cap.	143—146	..	130—146
223,130	,,	Aug. 11	3½	3½	Do. 3½ p.c. Red. Deb.	68—70	..	68—70½
285,249	,,	Aug. 11	6½	7	Lea Bridge 5 p.c. Ord.	96—99	..	94½—97
2,145,907	,,	Aug. 11	5½	5½	Liverpool 5 p.c. Ord.	88—89b	..	79—88½
600,000	,,	Sept 29	7	7	Do. 7 p.c. Red. Pref.	103—105b	..	102½—105
165,786	,,	Aug. 25	8	9	Maidstone 5 p.c. Cap.	107—112	..	108½—118½
75,000	5	Dec. 22	†7	†8	Malta & Mediterranean	5½—5¾*	—½	5 5/16
541,920	Stk.	Nov. 24	†7	†5	Montevideo, Ltd.	90—92	..	81—93
3,061,815	,,	July 28	5	5	Newcastle & Gateshead Con.	77⅞—78½d	..	..
360,929	,,	,,	4	4	Do. 4 p.c. Pref.	67½—69½d	..	..
691,705	,,	June 29	8½	8½	Do. 8½ p.c. Deb.	66½—67½d	..	..
131,785	,,	Aug. 25	—	6/18/0	North Middlesex 6 p.c. Con.	93—96	..	92
800,000	,,	Nov. 24	7	9	Oriental, Ltd.	105 -110	..	99—110
188,120	,,	Dec. 22	7⅞	7⅞	Plym'th & Ston'house 5 p.c.	102—107*	—3	106—110
414,500	,,	Aug. 25	7½	7½	Portam'th Con. Stk. 4p.c. Std.	102—105	..	103—104½
286,782	,,	,,	5	5	Do. 5 p.c. max.	76—79	..	77—80
3,389,909	1	—	—	—	Primitiva Ord.	19/—20/-	..	14/—21/7½
382,200	100	Dec. 1	4	4	Do. 4 p.c. Red. Deb.	90—93	+4	85 - 87
600,000	Stk.	July 28	4	4	Do. 4 p.c. Red. Deb. 1911	75—77	+2	70—74
434,968	,,	Dec. 22	4	4	Do. 4 p.c. Cons. Deb.	74—76*	+1	69½—74½
150,000	10	Sept. 29	6	6	San Paulo 6 p.c. Pref.	8½—8¾	..	7½—8⅝
125,000	50	June 29	5	5	Do. 5 p.c. Red. Deb.	47—49	..	48—48½
270,000	Stk.	Sept. 8	5½	5½	Sheffield A	102—104c	..	..
419,968	,,	,,	5½	5½	Do. B	102—104c	..	..
1,047,000	,,	,,	5½	5½	Do. C	102—104c	..	..
90,000	10	May 26	4	6	South African	4—6	..	4—4⅝
6,809,895	Stk.	Aug. 11	7	5	South Met. Ord.	102—104	..	94—102½
500,000	,,	—	—	—	Do. 6 p.c. Irred. Pf.	110—113	..	109½—112½
1,895,445	,,	July 14	3	3	Do. 3 p.c. Deb.	59—62	..	57½—61
784,000	,,	Sept. 8	6½	6½	Do. 6½ p.c. Red. Db.	102—104	..	100—103½
91,500	,,	Aug. 11	8½	8½	South Shields Con.	101—103d	..	..
1,343,795	,,	July 28	6½	6½	South Suburban Ord. 5 p.c.	102—105	..	98½—105½
868,887	,,	Dec. 22	5	5	Do. 5 p.c. Deb.	92 -95*	—1	93½—96
647,740	,,	Sept. 8	5	5	South'mpton Ord. 5 p.c. max	75—78	..	73½—77½
121,275	,,	Dec. 22	4	4	Do. 4 p.c. Deb.	72—75*	—1	70—75⅝
250,000	,,	Aug 25	7	7	Swansea 7 p.c. Red. Pref.	108—106	..	101—105
200,000	,,	Dec. 22	6½	6½	Do. 6½ p.c. Red. Deb.	99—102*	—1	102—103½
150,000	,,	July 28	7⅜	7⅜	Tottenham District A 5 p.c	107—110	..	107—110
882,275	,,	,,	6½	6½	Do. B 3½ p.c	91—94	..	90—94
160,000	,,	,,	5½	5½	Do. 5½ p.c. Pref.	97—100	..	..
151,255	,,	Dec. 8	4	4	Do. 4 p.c. Deb.	74—77	..	72—78½
258,251	,,	Sept. 29	5	5	Tynemouth Con. and New Uxbridge, Maidenhead, & Wycombe 5 p.c.	85—90	..	84½—91
263,094	,,	Aug. 25	6½	6½	Do. 5 p.c. pref.	88—88	..	81—87½
88,330	,,	,,	5	5	Wandsworth, Wimbledon, and Epsom—			
40,000	,,	July 14	8½	8½	Wandsworth A 5 p.c.	127 -132	+2	125—127½
256,686	,,	,,	7	7	Do. B 3½ p.c.	107 - 112	+2	100½—107½
437,535	,,	,,	5/12,0	5/12,0	Do. C and New	94—99	+4	88½—97½
352,000	,,	,,	6⅝	6⅝	Do. Wimbledon 5 p.c.	102 -107	+2	96—103½
98,000	,,	,,	7½	7½	Do. Epsom 5 p.c.	110 115	+3	104½—109½
210,000	,,	,,	5	5	Do. 5 p.c. Pref.	87 - 92	+2	85—86½
88,416	,,	Dec. 22	8	8	Do. 3 p.c. Deb.	56 -59*	..	52½—58½
224,743	,,	,,	4	4	Do. 4 p.c. Deb.	73—76*	—1	75

Quotations at:—a.—Bristol. b.—Liverpool. c.—Nottingham. d.—Newcastle e.—Sheffield. * Ex. div. † Paid free of income-tax. ‡ For year.

Do all your Sales and Service Men receive a copy of each issue of the "GAS SALESMAN"? Specimen copies and prices from Walter King, Ltd., 11, Bolt Court, Fleet St., E.C.4

Municipal Support for the "Come to Britain" Movement.

The Information Department of the organization known as the "Come to Britain" Movement sends the following: The Secretary of the Association of Municipal Corporations has informed the Director that at a full meeting of the Association held on Nov. 24 in the Council Chamber of the Guildhall, at which the Earl of Derby presided and 133 towns were represented, the following resolution was passed almost unanimously: "That in view of the great importance of encouraging more people from abroad to visit this country, His Majesty's Government be urged to procure the passing of legislation at an early date to enable local authorities to make contributions towards the cost of an approved organization formed for that object, and that the Council of the Association be requested to use every effort to give effect to this resolution." A copy of the following resolution, which was passed unanimously, has been received from the Shipowners' Parliamentary Committee: "That support be given to proposals in any general bill empowering corporations and municipal bodies to spend money on advertising." The thanks of the Movement have been conveyed to Lord Derby, the Association of Municipal Corporations, and the Shipowners' Parliamentary Committee for their timely encouragement and support. Col. the Hon. F. Vernon Willey, C.M.G., will act as Hon. Treasurer of the Movement during the absence of the Rt. Hon. Lord Ebury, D.S.O., M.C., in India.

Gas Prices Reduced at Aberystwyth.—Gas is to be reduced at Aberystwyth from 4s. 6d. to 3s. 9d. per 1000 c.ft.

Lower Charges by South Suburban Gas Company.—The Company have reduced the price of gas by 0·6d. per therm.

"B.C.G.A." Advertising.—The whole of the front page of "The Times" Review of the Year 1927 is taken up by the British Commercial Gas Association.

Lower Gas Prices at Cork.—The Directors of the Cork Gas Consumers' Company announce a reduction of 1d. per therm (equivalent to 5d. per 1000 c.ft.) in the price of gas.

Gas Light and Coke Company's Further Price Reduction.—Following upon a recent reduction of 0·4d. per therm (2d. per 1000 c.ft.), the Company have further reduced the price of gas by 0·4d. per therm for the present (March) quarter. Gas is now 25 p.ct. cheaper than it was this time last year.

Reduction at Consett.—The Shotley Bridge and Consett District Gas Company have reduced the price of gas from 10·8d. to 10·2d. per therm to ordinary consumers, with a discount of 6d. per 1000 c.ft. for prompt payment. To slot consumers, the number of cubic feet obtainable for 1d. has been increased from 16 to 17.

Successful Cookery Demonstrations at Sutton.—A series of practical cookery demonstrations recently given by Miss H. Crawford-Fox, A.T.C.L., in the lecture hall attached to the new showrooms of the Sutton Gas Company proved a great success. Nearly one thousand consumers attended the demonstrations, held daily over a period of three weeks.

Knaresborough Gas Undertaking.—On New Year's Day the Knaresborough Urban District Council's gas-works passed into the hands of the Harrogate Gas Company, at the price of £16,000, excluding stock. The Council have decided to utilize the money in wiping-out several outstanding loans to the amount of £15,385. It is anticipated that the saving of interest thereby will enable the Council to make a reduction in the Knaresborough local rates.

Records at Birmingham.—The Birmingham Gas Department established three records during Christmas. In the week preceding Christmas, the output of gas was 379,535,000 c.ft.; and in the week following it, the consumption was 311,767,000 c.ft. In each instance the largest previous figures of the Department were beaten. The daily record consumption was also broken in the week preceding Christmas, with 62½ million c.ft. These figures were reported to the Gas Committee at a meeting on Monday last.

Ventilation of Geysers.—"I hope it will be made compulsory to fit every geyser with an efficient flue to carry off the products of combustion," said the Bristol Coroner at an inquest on Ivy Chippett, who was found dead in her bathroom. The jury returned a verdict of "Carbon monoxide poisoning," adding a rider that they were not satisfied with the construction of the geyser. The Coroner said that carelessly-constructed geysers were most dangerous. The only way to prevent such deaths was to enforce the use of a flue.

Long Service at Birmingham.—At a meeting of the Birmingham Gas Committee last Monday—Alderman J. H. Lloyd presiding—testimonials expressing appreciation of long and efficient service were presented to the following. Thomas H. Wright, in the fittings staff at Wednesbury for 42 years. He fitted the first prepayment meter in the Wednesbury district. George Enoch White, 36 years' service as a retort house hand at the Swan Vilage Works. Harry Bonehill, who had worked with the Department since 1889 in various capacities.

Results at Oswaldtwistle.—The Oswaldtwistle Treasurer's annual abstract of accounts reveals a net profit on the gas-works of £3235, after providing £1370 for instalment charges, and £1463 for interest on loans. The charges against revenue include £1087 for new showrooms and £1214 for public street lighting. The gas-works reserve fund was increased during the year from £2802 to £4386. The capital outlay was £1962, making the total outlay £107,385; over £27,000 having been expended in the last two years. The mortgage debt outstanding is £30,256.

Annual Dinner at Weymouth.—Speaking at the annual dinner given by the Weymouth Consumers' Gas Company to their employees, Mr. Mark C. Frowde, J.P., Chairman of Directors, observed that the harmonious relationship which existed between employers and employed in the Company accounted for the continued prosperity of the firm, as shown by the increased amount of gas sold. This was about 10 p.ct. greater than in the corresponding period a year ago. They had more than trebled their consumers of coke. Perhaps this was due to the fact that they had erected a coke cutting and screening plant.

Dry Gasholders has been registered as a private company, with a nominal capital of £5000 in £1 shares, to carry on the business of contractors for, and manufacturers and erectors of, installations of tankless gasholders, gas engineers, gas plant manufacturers, iron-founders, mechanical engineers, &c., and to adopt an agreement with the Offene Handels Gesellschaft Aug. Klonne, of Dortmund, Germany. The Directors are Messrs. S. Cutler (appointed by Samuel Cutler & Son), R. J. Milbourne (appointed by C. & W. Walker, Ltd.) W. Beswick (appointed by Ashmore, Benson, Pease, & Co., Ltd.), and T. V. Miles (appointed by Newton, Chambers, & Co.). The registered office is at 39, Victoria Street, S.W. 1.

South Metropolitan Gas Company.—Statistics in the Company's "Co-Partnership Almanack" for 1928 show that the capital of the South Metropolitan Gas Company is £9,239,340. The Company carbonize 1¾ milion tons of coal per annum. They supply gas to 411,000 consumers through 1400 miles of mains, the largest of which is 4 ft. in diameter. The area of supply comprises over 51 square miles. They have two chemical works dealing with bye-products from 12 million gallons of tar and 50 million gallons of ammoniacal liquor annually. They employ over 9000 workers, of whom over 7000 are stockholders in the Company, electing representatives to the Co-Partnership Committee and to the Board of Directors.

Bilston Gas Light and Coke Company.—The Directors' report for the year ended Sept. 30, which was submitted at a meeting of the Company on Jan. 2, stated that, after paying the interim dividends, there remained a credit balance of £15,119. On Jan. 2, further dividends were declared of 5s. 6d. per share on the "A" shares (less tax) and 4s. on the "B" shares (less tax), making, with the interim dividends paid in July last, 11s. and 8s. per share respectively for the year. A balance of £12,971 was carried forward. The Directors regretted that, owing to continued ill-health, Mr. Harold Holcroft had definitely resigned his seat on the Board. Mr. Holcroft has been a Director of the Company for 44 years, during 24 years of which he was Chairman. Mr. John Willim Hall, who has been a Director of the Company for 39 years, has been appointed Chairman.

Just before 8 o'clock on Dec. 25, there was an electric failure at Weymouth.

Last Saturday four people residing in the ground flat of a tenement building in Oatlands, Glasgow, were fatally poisoned by gas. The escape, it is thought, was due to the fracture of a main by frost.

The Bradford fire brigade were called on the night of Dec. 21 to an outbreak at the stove and fire store of the Bradford Gas Department; but it was found that the fire was among a number of workmen's tools, and the outbreak was extinguished without much damage being done.

A Note to the Manufacturers—

The "Gas Journal" Calendar and Directory would be of the greatest assistance to your Representatives.